Solid Waste

# ♼EPA

# Best Demonstrated Available Technology (BDAT) Background Document for Chlorinated Organics Treatability Group (K016, K018, K019, K020, K030)

# Proposed

Volume 2

BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT

SUPPORTING THE PROPOSED

LAND DISPOSAL RESTRICTIONS RULE

FOR

FIRST THIRD WASTES

VOLUME 2

CHLORINATED ORGANIC WASTE CODES

K016, K018, K019, K020, K030

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

## LIST OF TABLES

LIST OF TABLES (Continued)

# LIST OF FIGURES

# EXECUTIVE SUMMARY

## BDAT Treatment Standards
## K016, K018, K019, K020, and K030

Pursuant to the Hazardous and Solid Waste Amendments (HSWA) enacted

on November 8, 1984 and in accordance with the procedures for establishing

treatment standards under section 3004(m) of the Resource, Conservation and

Recovery Act (RCRA), the Environmental Protection Agency (EPA) is proposing

treatment standards for the listed wastes, K016, K018, K019, K020, and K030

from the organic chemical industry. These treatment standards are based on

the performance of the treatment technology determined by the Agency to

represent Best Demonstrated Available Technology (BDAT), rotary kiln inciner-

ation. This background document provides the detailed analyses that support

this determination.


These BDAT treatment standards represent maximum acceptable concen-

tration levels for selected hazardous constituents in the wastes or residuals

from treatment and/or recycling. These levels are established as a prerequi-

site for land disposal of these wastes in accordance with 40 CFR Part 268

(Code of Federal Regulations). Wastes that when generated contain the regu-

lated constituents at concentrations that do not exceed the treatment

standards are not restricted from land disposal. The Agency has chosen to set

levels for these wastes rather than designate the use of a specific treatment

technology. The Agency believes that this allows the generators of these

wastes a greater degree of flexibility in selecting a technology or train of technologies that can achieve these standards.

These proposed standards become effective no later than August 8, 1988, as described in the schedule set forth in 40 CFR 268.10. However, because of the lack of nationwide incineration capacity at this time, the Agency is proposing to grant a two year nationwide variance to the effective date of the land disposal restriction for these wastes.

According to 40 CFR 261.32 (hazardous wastes from specific sources), waste codes K016, K018, K019, K020, and K030, which are generated by the organic chemicals industry, are listed as follows:

K016:     Heavy ends or distillation residues from the production of carbon tetrachloride

K018:     Heavy ends from the fractionation column in ethyl chloride production

K019:     Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production

K020:     Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production

K030:     Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene

Descriptions of the industry and specific processes generating these wastes, as well as descriptions of the physical and chemical waste characteristics, are provided in Section 2.0 of this document. The four digit Standard Industrial Classification (SIC) code most often reported for the industry

generating these wastes is 2869 (Industrial Organic Chemicals, Not Elsewhere Classified). The Agency estimates that there are approximately 47 facilities that may generate wastes identified as K016, K018, K019, K020, and K030.

The Agency has determined that K016, K018, K019, K020, and K030 collectively represent one general waste treatability group with two subgroups - wastewaters and nonwastewaters. For the purpose of the land disposal restrictions rule, wastewaters are defined as wastes containing less than or equal to 1% (weight basis) filterable solids and less than or equal to 1% (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters.

These waste treatability subgroups represent classes of wastes that have similar physical and chemical properties within each treatability group. EPA believes that each waste within these subgroups can be treated to the same concentration when similar technologies are applied. The Agency has examined the sources of these five organic chemical wastes, the specific similarities in waste composition, applicable and demonstrated treatment technologies, and attainable treatment performance in order to support a simplified regulatory approach. While the Agency has not, at this time, specifically identified additional wastes that fall into this treatability group or two subgroups, this does not preclude the Agency from using the treatment performance data used to develop these standards to develop standards for other similar wastes, in the future. A detailed discussion of applicable and demonstrated treatment technologies is provided in Section 3.0 of this document.

K016, K018, K019, K020, and K030, as generated, are distillation residues containing high concentrations of organic constituents and low concentrations of metals and typically meet the definition of nonwastewaters. Solid residues from the treatment of these organic wastes (such as incinerator ash) are also included in this classification of nonwastewater. K016, K018, K019, K020, and K030 wastewaters are generated primarily as a result of the "derived-from rule" and the "mixture rule" as outlined in 40 CFR 261.3 (definition of hazardous waste). The most common K016, K018, K019, K020, and K030 wastewaters are aqueous residues from treatment (such as scrubber waters and direct contact cooling waters) and inadvertent mixtures of K016, K018, K019, K020, and K030 with other aqueous wastes.

The Agency is proposing BDAT treatment standards for the two treatability subgroups of K016, K018, K019, K020, and K030 wastes - wastewaters and nonwastewaters. In general, these treatment standards have been proposed for a total of 24 organic constituents which the Agency believes are indicators of effective treatment for all of the BDAT hazardous constituents that have been identified as present in the K016, K018, K019, K020, and K030 wastes. The organic constituents that are proposed for regulation in one or more of these five waste codes are: carbon tetrachloride, chlorobenzene, chloroethane, chloroform, chloromethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, bis(2-chloroethyl)ether, p-Dichlorobenzene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloroethane,

hexachloropropene, naphthalene, pentachlorobenzene, pentachloroethane, phenanthrene, 1,2,4,5-tetrachlorobenzene, and 1,2,4-trichlorobenzene. Not all constituents are proposed for regulation in all of the five waste codes because either the constituents were not found in treatable quantities in the untreated wastes or the Agency believes that they will be effectively controlled through regulation of other constituents. A detailed discussion of the selection of constituents to be regulated is presented in Section 5.0 of this document.

BDAT treatment standards for K016, K018, K019, K020, and K030 nonwastewater are proposed based on performance data from treatment by full-scale rotary kiln incineration of representative samples of nonwastewater K019. Performance data were not available from other treatment technologies. Treatment performance data were transferred from K019 to nonwastewater K016, K018, K020, and K030 for development of treatment standards for these wastes. Rotary kiln incineration was determined to represent the best demonstrated available technology (BDAT) for K016, K018, K019, K020, and K030 nonwaste-waters. A detailed discussion of the identification of BDAT is presented in Section 4.0 of this document. Proposed BDAT treatment standards for K016, K018, K019, K020, and K030 wastewaters were developed based on data for scrubber water from the rotary kiln incineration of K019 nonwastewaters. A detailed discussion on transfer of data for development of proposed treatment standards for wastewater and nonwastewater K016, K018, K020, and K030 is presented in Section 6.0 of this document.

This background document presents two methods for selection of constituents for regulation. The constituents proposed for regulation in wastewater were selected by considering the concentrations of BDAT List organic constituents present in the untreated wastes K016, K018, K019, K020, and K030. Also presented in the document is an alternative method for selection of regulated constituents in wastewater which was developed after the method used for proposal and which the Agency will consider for the final rule. This method was used for selection of proposed regulated constituents for nonwastewater forms of K016, K018, K019, K020, and K030 and for most wastecodes in this proposal. In the alternate method, constituents are selected for regulation after consideration of their concentrations in the untreated waste, the level of control of the constituent that can be expected through treatment required to comply with treatment standards established for other constituents in the waste, and the relative difficulty associated with achievement of effective treatment of the constituent by BDAT. In the alternate method, EPA is basing its judgment of the level of difficulty of treatment on the waste characteristics affecting performance of incineration relative to constituents in the scrubber water residual, specifically, the bond dissociation energy for the constituent.

The same steps were taken in calculation of wastewater treatment standards under the proposed and alternative methods: (1) treatment concentration data were adjusted for accuracy to account for analytical interferences associated with the chemical make-up of the sample, and (2) the

average of the adjusted data points was multiplied by a variability factor to account for the variability inherent in the performance of the treatment system, collection of samples, and analysis of samples. Numerical values of treatment standards calculated for the proposed and alternate methods differ slightly due to changes in the methodology used in transfer of accuracy correction factors and variability factors when these factors were not available or could not be calculated for constituent.

The following tables list the proposed BDAT treatment standards for wastes identified as K016, K018, K019, K020, and K030. The Agency is setting standards based on analysis of total constituent concentration for K016, K018, K019, K020, and K030 nonwastewaters and wastewaters. The units for total constituent concentration are in parts per million on a weight by weight basis (mg/kg) for nonwastewaters and in parts per million on a weight-by-volume basis (mg/l) for wastewaters.

# BDAT TREATMENT STANDARDS
## FOR
## NONWASTEWATER KO16, KO18, KO19, KO20, AND KO30

| Regulated Organic Constituents | Total Concentration (mg/kg) | | | | |
| --- | --- | --- | --- | --- | --- |
| | KO16 | KO18 | KO19 | KO20 | KO30 |
| 9. Chlorobenzene | NA | NA | 5.66 | NA | NA |
| 12. Chloroethane | NA | 5.96 | NA | NA | NA |
| 14. Chloroform | NA | NA | 5.96 | NA | NA |
| 22. 1,1-Dichloroethane | NA | 5.96 | NA | NA | NA |
| 23. 1,2-Dichloroethane | NA | 5.96 | 5.96 | 5.96 | NA |
| 41. 1,1,2,2-Tetrachloroethane | NA | NA | NA | 5.44 | NA |
| 42. Tetrachloroethene | 5.96 | NA | 5.96 | 5.96 | 5.96 |
| 45. 1,1,1-Trichloroethane | NA | 5.96 | 5.96 | NA | NA |
| 68. Bis(2-chloroethyl)ether | NA | NA | 5.44 | NA | NA |
| 110. Hexachlorobenzene | 27.2 | 27.2 | NA | NA | NA |
| 111. Hexachlorobutadiene | 5.44 | 5.44 | NA | NA | 5.44 |
| 112. Hexachlorocyclopentadiene | 5.44 | NA | NA | NA | NA |
| 113. Hexachloroethane | 27.2 | 27.2 | 27.2 | NA | 27.2 |
| 115. Hexachloropropene | NA | NA | NA | NA | 18.7 |
| 121. Naphthalene | NA | NA | 5.44 | NA | NA |
| 136. Pentachlorobenzene | NA | NA | NA | NA | 27.2 |
| 137. Pentachloroethane | NA | 5.44 | NA | NA | 5.44 |
| 141. Phenanthrene | NA | NA | 5.44 | NA | NA |
| 148. 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | 13.6 |
| 150. 1,2,4-Trichlorobenzene | NA | NA | 18.7 | NA | 18.7 |

NA - Not applicable. This constituent is not being proposed for regulation for this waste.

## BDAT TREATMENT STANDARDS FOR
## WASTEWATER KO16, KO18, KO19, KO20, AND KO30

| Regulated Organic Constituents | Total Concentration (mg/L) | | | | |
| --- | --- | --- | --- | --- | --- |
| | KO16 | KO18 | KO19 | KO20 | KO30 |
| 7. Carbon Tetrachloride | NA | NA | 0.014 | NA | NA |
| 12. Chloroethane | NA | 0.014 | NA | NA | NA |
| 14. Chloroform | NA | NA | 0.014 | NA | NA |
| 15. Chloromethane | NA | 0.014 | NA | NA | NA |
| 22. 1,1-Dichloroethane | NA | 0.014 | NA | NA | NA |
| 23. 1,2-Dichloroethane | NA | 0.014 | 0.014 | 0.014 | NA |
| 41. 1,1,2,2-Tetrachloroethane | NA | NA | NA | 0.009 | NA |
| 42. Tetrachloroethene | 0.014 | NA | 0.014 | 0.014 | 0.014 |
| 45. 1,1,1-Trichloroethane | NA | 0.014 | NA | NA | NA |
| 46. 1,1,2-Trichloroethane | NA | NA | 0.014 | NA | NA |
| 68. Bis(2-chloroethyl)ether | NA | NA | 0.010 | NA | NA |
| 88. p-Dichlorobenzene | NA | NA | 0.009 | NA | NA |
| 110. Hexachlorobenzene | 0.050 | 0.050 | 0.050 | NA | NA |
| 111. Hexachlorobutadiene | 0.010 | 0.010 | NA | NA | 0.010 |
| 112. Hexachlorocyclopentadiene | 0.025 | NA | NA | NA | NA |
| 113. Hexachloroethane | 0.050 | NA | 0.050 | 0.050 | 0.050 |
| 115. Hexachloropropene | NA | NA | NA | NA | 0.025 |
| 121. Naphthalene | NA | NA | 0.010 | NA | NA |
| 136. Pentachlorobenzene | NA | NA | 0.050 | NA | NA |
| 137. Pentachloroethane | NA | 0.009 | NA | 0.009 | 0.009 |
| 148. 1,2,4,5-Tetrachlorobenzene | NA | NA | 0.025 | NA | 0.025 |
| 150. 1,2,4-Trichlorobenzene | NA | NA | 0.025 | NA | 0.025 |

NA - Not Applicable.  This constituent is not being proposed for regulation for this waste.

ix

# 1. INTRODUCTION

This section of the background document presents a summary of the legal authority pursuant to which the BDAT treatment standards were developed, a summary of EPA's promulgated methodology for developing BDAT, and finally a discussion of the petition process that should be followed to request a variance from the BDAT treatment standards.

## 1.1     Legal Background

### 1.1.1     Requirements Under HSWA

The Hazardous and Solid Waste Amendments of 1984 (HSWA), enacted on November 8, 1984, and which amended the Resource Conservation and Recovery Act of 1976 (RCRA), impose substantial new responsibilities on those who handle hazardous waste. In particular, the amendments require the Agency to promulgate regulations that restrict the land disposal of untreated hazardous wastes. In its enactment of HSWA, Congress stated explicitly that "reliance on land disposal should be minimized or eliminated, and land disposal, particularly landfill and surface impoundment, should be the least favored method for managing hazardous wastes" (RCRA section 1002(b)(7), 42 U.S.C. 6901(b)(7)).

One part of the amendments specifies dates on which particular groups of untreated hazardous wastes will be prohibited from land disposal unless "it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous" (RCRA section 3004(d)(1), (e)(1), (g)(5), 42 U.S.C. 6924 (d)(1), (e)(1), (g)(5)).

For the purpose of the restrictions, HSWA defines land disposal "to include, but not be limited to, any placement of . . . hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave" (RCRA section 3004(k), 42 U.S.C. 6924(k)). Although HSWA defines land disposal to include injection wells, such disposal of solvents, dioxins, and certain other wastes, known as the California List wastes, is covered on a separate schedule (RCRA section 3004(f)(2), 42 U.S.C. 6924 (f)(2)). This schedule requires that EPA develop land disposal restrictions for deep well injection by August 8, 1988.

The amendments also require the Agency to set "levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized" (RCRA section 3004(m)(1), 42 U.S.C. 6924 (m)(1)). Wastes that meet treatment standards established by EPA are not prohibited and may be land disposed. In setting treatment standards for listed or characteristic wastes, EPA may establish different standards for particular wastes within a single waste code with differing treatability characteristics. One such characteristic is the physical form of the waste. This frequently leads to different standards for wastewaters and nonwastewaters.

Alternatively, EPA can establish a treatment standard that is applicable to more than one waste code when, in EPA's judgment, all the waste can be treated to the same concentration. In those instances where a generator can demonstrate that the standard promulgated for the generator's waste cannot be achieved, the Agency also can grant a variance from a treatment standard by revising the treatment standard for that particular waste through rulemaking procedures. (A further discussion of treatment variances is provided in Section 1.3.)

The land disposal restrictions are effective when promulgated unless the Administrator grants a national variance and establishes a different date (not to exceed 2 years beyond the statutory deadline) based on "the earliest date on which adequate alternative treatment, recovery, or disposal capacity which protects human health and the environment will be available" (RCRA section 3004(h)(2), 42 U.S.C. 6924 (h)(2)).

If EPA fails to set a treatment standard by the statutory deadline for any hazardous waste in the First Third or Second Third of the schedule (see section 1.1.2), the waste may not be disposed in a landfill or surface impoundment unless the facility is in compliance with the minimum technological requirements specified in section 3004(o) of RCRA. In addition, prior to disposal, the generator must certify to the Administrator that the availability of treatment capacity has been investigated and it has been determined that disposal in a landfill or surface impoundment is the only practical alternative to treatment currently available to the generator. This restriction on the use of

landfills and surface impoundments applies until EPA sets a treatment standard for the waste or until May 8, 1990, whichever is sooner. If the Agency fails to set a treatment standard for any ranked hazardous waste by May 8, 1990, the waste is automatically prohibited from land disposal unless the waste is placed in a land disposal unit that is the subject of a successful "no migration" demonstration (RCRA section 3004(g), 42 U.S.C. 6924(g)). "No migration" demonstrations are based on case-specific petitions that show there will be no migration of hazardous constituents from the unit for as long as the waste remains hazardous.

## 1.1.2 Schedule for Developing Restrictions

Under Section 3004(g) of RCRA, EPA was required to establish a schedule for developing treatment standards for all wastes that the Agency had listed as hazardous by November 8, 1984. Section 3004(g) required that this schedule consider the intrinsic hazards and volumes associated with each of these wastes. The statute required EPA to set treatment standards according to the following schedule:

(a) Solvents and dioxins standards must be promulgated by November 8, 1986;

(b) The "California List" must be promulgated by July 8, 1987;

(c) At least one-third of all listed hazardous wastes must be promulgated by August 8, 1988 (First Third);

(d) At least two-thirds of all listed hazardous wastes must be promulgated by June 8, 1989 (Second Third); and

(e) All remaining listed hazardous wastes and all hazardous wastes identified as of November 8, 1984, by one or more of the characteristics defined in 40 CFR Part 261 must be promulgated by May 8, 1990 (Third Third).

The statute specifically identified the solvent wastes as those covered under waste codes F001, F002, F003, F004, and F005; it identified the dioxin-containing hazardous wastes as those covered under waste codes F020, F021, F022, and F023.

Wastes collectively known as the California List wastes, defined under Section 3004(d) of HSWA, are liquid hazardous wastes containing metals, free cyanides, PCBs, corrosives (i.e., a pH less than or equal to 2.0), and any liquid or nonliquid hazardous waste containing halogenated organic compounds (HOCs) above 0.1 percent by weight. Rules for the California List were proposed on December 11, 1986, and final rules for PCBs, corrosives, and HOC-containing wastes were established August 12, 1987. In that rule, EPA elected not to establish standards for metals. Therefore, the statutory limits became effective.

On May 28, 1986, EPA published a final rule (51 FR 19300) that delineated the specific waste codes that would be addressed by the First Third, Second Third, and Third Third. This schedule is incorporated into 40 CFR 268.10, .11, and .12.

1.2    Summary of Promulgated BDAT Methodology

In a November 7, 1986, rulemaking, EPA promulgated a technology-based approach to establishing treatment standards under section 3004(m). Section 3004(m) also specifies that treatment standards must "minimize" long- and short-term threats to human health and the environment arising from land disposal of hazardous wastes.

Congress indicated in the legislative history accompanying the HSWA that "[t]he requisite levels of [sic] methods of treatment established by the Agency should be the best that has been demonstrated to be achievable," noting that the intent is "to require utilization of available technology" and not a "process which contemplates technology-forcing standards" (Vol. 130 Cong. Rec. S9178 (daily ed., July 25, 1984)). EPA has interpreted this legislative history as suggesting that Congress considered the requirement under 3004(m) to be met by application of the best demonstrated and achievable (i.e., available) technology prior to land disposal of wastes or treatment residuals. Accordingly, EPA's treatment standards are generally based on the performance of the best demonstrated available technology (BDAT) identified for treatment of the hazardous constituents. This approach involves the identification of potential treatment systems, the determination of whether they are demonstrated and available, and the collection of treatment data from well-designed and well-operated systems.

The treatment standards, according to the statute, can represent levels or methods of treatment, if any, that substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents. Wherever possible, the Agency prefers to establish BDAT treatment standards as "levels" of treatment (i.e., performance standards) rather than adopting an approach that would require the use of specific treatment "methods." EPA believes that concentration-based treatment levels offer the regulated community greater

flexibility to develop and implement compliance strategies as well as an incentive to develop innovative technologies.

## 1.2.1 Waste Treatability Group

In developing the treatment standards, EPA first characterizes the waste(s). As necessary, EPA may establish treatability groups for wastes having similar physical and chemical properties. That is, if EPA believes that wastes represented by different waste codes could be treated to similar concentrations using identical technologies, the Agency combines the codes into one treatability group. EPA generally considers wastes to be similar when they are both generated from the same industry and from similar processing stages. In addition, EPA may combine two or more separate wastes into the same treatability group when data are available showing that the waste characteristics affecting performance are similar or that one waste would be expected to be less difficult to treat.

Once the treatability groups have been established, EPA collects and analyzes data on identified technologies used to treat the wastes in each treatability group. The technologies evaluated must be demonstrated on the waste or a similar waste and must be available for use.

## 1.2.2  Demonstrated and Available Treatment Technologies

Consistent with legislative history, EPA considers demonstrated technologies to be those that are used to treat the waste of interest or a similar waste with regard to parameters that affect treatment selection (see November 7, 1986, 51 FR 40588). EPA also will consider as treatment those technologies used to separate or otherwise process chemicals and

other materials. Some of these technologies clearly are applicable to waste treatment, since the wastes are similar to raw materials processed in industrial applications.

For most of the waste treatability groups for which EPA will promulgate treatment standards, EPA will identify demonstrated technologies either through review of literature related to current waste treatment practices or on the basis of information provided by specific facilities currently treating the waste or similar wastes.

In cases where the Agency does not identify any facilities treating wastes represented by a particular waste treatability group, EPA may transfer a finding of demonstrated treatment. To do this, EPA will compare the parameters affecting treatment selection for the waste treatability group of interest to other wastes for which demonstrated technologies already have been determined. The parameters affecting treatment selection and their use for this waste are described in Section 3.4 of this document. If the parameters affecting treatment selection are similar, then the Agency will consider the treatment technology also to be demonstrated for the waste of interest. For example, EPA considers rotary kiln incineration a demonstrated technology for many waste codes containing hazardous organic constituents, high total organic content, and high filterable solids content, regardless of whether any facility is currently treating these wastes. The basis for this determination is data found in literature and data generated by EPA confirming the use of rotary kiln incineration on wastes having the above characteristics.

If no commercial treatment or recovery operations are identified for a waste or wastes with similar physical or chemical characteristics that affect treatment selection, the Agency will be unable to identify any demonstrated treatment technologies for the waste, and, accordingly, the waste will be prohibited from land disposal (unless handled in accordance with the exemption and variance provisions of the rule). The Agency is, however, committed to establishing treatment standards as soon as new or improved treatment processes are demonstrated (and available).

Operations only available at research facilities, pilot- and bench-scale operations will not be considered in identifying demonstrated treatment technologies for a waste because these technologies would not necessarily be "demonstrated." Nevertheless, EPA may use data generated at research facilities in assessing the performance of demonstrated technologies.

As discussed earlier, Congress intended that technologies used to establish treatment standards under Section 3004(m) be not only "demonstrated," but also available. To decide whether demonstrated technologies may be considered "available," the Agency determines whether they (1) are commercially available and (2) substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste.

EPA will only set treatment standards based on a technology that meets the above criteria. Thus, the decision to classify a technology as "unavailable" will have a direct impact on the treatment standard. If

the best technology is unavailable, the treatment standard will be based on the next best treatment technology determined to be available. To the extent that the resulting treatment standards are less stringent, greater concentrations of hazardous constituents in the treatment residuals could be placed in land disposal units.

There also may be circumstances in which EPA concludes that for a given waste none of the demonstrated treatment technologies are "available" for purposes of establishing the 3004(m) treatment performance standards. Subsequently, these wastes will be prohibited from continued placement in or on the land unless managed in accordance with applicable exemptions and variance provisions. The Agency is, however, committed to establishing new treatment standards as soon as new or improved treatment processes become "available."

(1) Proprietary or Patented Processes. If the demonstrated treatment technology is a proprietary or patented process that is not generally available, EPA will not consider the technology in its determination of the treatment standards. EPA will consider proprietary or patented processes available if it determines that the treatment method can be purchased or licensed from the proprietor or is commercially available treatment. The services of the commercial facility offering this technology often can be purchased even if the technology itself cannot be purchased.

(2) Substantial Treatment. To be considered "available," a demonstrated treatment technology must "substantially diminish the

toxicity" of the waste or "substantially reduce the likelihood of migration of hazardous constituents" from the waste in accordance with section 3004(m). By requiring that substantial treatment be achieved in order to set a treatment standard, the statute ensures that all wastes are adequately treated before being placed in or on the land and ensures that the Agency does not require a treatment method that provides little or no environmental benefit. Treatment will always be deemed substantial if it results in nondetectable levels of the hazardous constituents of concern. If nondetectable levels are not achieved, then a determination of substantial treatment will be made on a case-by-case basis. This approach is necessary because of the difficulty of establishing a meaningful guideline that can be applied broadly to the many wastes and technologies to be considered. EPA will consider the following factors in an effort to evaluate whether a technology provides substantial treatment on a case-by-case basis:

(a) Number and types of constituents treated;

(b) Performance (concentration of the constituents in the treatment residuals); and

(c) Percent of constituents removed.

If none of the demonstrated treatment technologies achieve substantial treatment of a waste, the Agency cannot establish treatment standards for the constituents of concern in that waste.

1.2.3    Collection of Performance Data

Performance data on the demonstrated available technologies are evaluated by the Agency to determine whether the data are representative

of well-designed and well-operated treatment systems. Only data from well-designed and well-operated systems are included in determining BDAT. The data evaluation includes data already collected directly by EPA and/or data provided by industry. In those instances where additional data are needed to supplement existing information, EPA collects additional data through a sampling and analysis program. The principal elements of this data collection program are: (a) identification of facilities for site visits, (b) engineering site visit, (c) Sampling and Analysis Plan, (d) sampling visit, and (e) Onsite Engineering Report.

(1) <u>Identification of Facilities for Site Visits</u>. To identify facilities that generate and/or treat the waste of concern, EPA uses a number of information sources. These include Stanford Research Institute's Directory of Chemical Producers, EPA's Hazardous Waste Data Management System (HWDMS), the 1986 Treatment, Storage, Disposal Facility (TSDF) National Screening Survey, and EPA's Industry Studies Data Base. In addition, EPA contacts trade associations to inform them that the Agency is considering visits to facilities in their industry and to solicit assistance in identifying facilities for EPA to consider in its treatment sampling program.

After identifying facilities that treat the waste, EPA uses this hierarchy to select sites for engineering visits: (1) generators treating single wastes on site; (2) generators treating multiple wastes together on site; (3) commercial treatment, storage, and disposal facilities

(TSDFs); and (4) EPA in-house treatment. This hierarchy is based on two concepts: (1) to the extent possible, EPA should develop treatment standards from data produced by treatment facilities handling only a single waste, and (2) facilities that routinely treat a specific waste have had the best opportunity to optimize design parameters. Although excellent treatment can occur at many facilities that are not high in this hierarchy, EPA has adopted this approach to avoid, when possible, ambiguities related to the mixing of wastes before and during treatment.

When possible, the Agency will evaluate treatment technologies using commercially operated systems. If performance data from properly designed and operated commercial treatment methods for a particular waste or a waste judged to be similar are not available, EPA may use data from research facilities operations. Whenever research facility data are used, EPA will explain why such data were used in the preamble and background document and will request comments on the use of such data.

Although EPA's data bases provide information on treatment for individual wastes, the data bases rarely provide data that support the selection of one facility for sampling over another. In cases where several treatment sites appear to fall into the same level of the hierarchy, EPA selects sites for visits strictly on the basis of which facility could most expeditiously be visited and later sampled if justified by the engineering visit.

(2) Engineering Site Visit. Once a treatment facility has been selected, an engineering site visit is made to confirm that a candidate for sampling meets EPA's criteria for a well-designed facility and to ensure that the necessary sampling points can be accessed to determine operating parameters and treatment effectiveness. During the visit, EPA also confirms that the facility appears to be well operated, although the actual operation of the treatment system during sampling is the basis for EPA's decisions regarding proper operation of the treatment unit. In general, the Agency considers a well-designed facility to be one that contains the unit operations necessary to treat the various hazardous constituents of the waste as well as to control other nonhazardous materials in the waste that may affect treatment performance.

In addition to ensuring that a system is reasonably well designed, the engineering visit examines whether the facility has a way to measure the operating parameters that affect performance of the treatment system during the waste treatment period. For example, EPA may choose not to sample a treatment system that operates in a continuous mode, for which an important operating parameter cannot be continuously recorded. In such systems, instrumentation is important in determining whether the treatment system is operating at design values during the waste treatment period.

(3) Sampling and Analysis Plan. If after the engineering site visit the Agency decides to sample a particular plant, the Agency will then develop a site-specific Sampling and Analysis Plan (SAP) according to the Generic Quality Assurance Project Plan for the Land Disposal Restriction

Program ("BDAT"), EPA/530-SW-87-011. In brief, the SAP discusses where the Agency plans to sample, how the samples will be taken, the frequency of sampling, the constituents to be analyzed and the method of analysis, operational parameters to be obtained, and specific laboratory quality control checks on the analytical results.

The Agency will generally produce a draft of the site-specific Sampling and Analysis Plan within 2 to 3 weeks of the engineering visit. The draft of the SAP is then sent to the plant for review and comment. With few exceptions, the draft SAP should be a confirmation of data collection activities discussed with the plant personnel during the engineering site visit. EPA encourages plant personnel to recommend any modifications to the SAP that they believe will improve the quality of the data.

It is important to note that sampling of a plant by EPA does not mean that the data will be used in the development of treatment standards for BDAT. EPA's final decision on whether to use data from a sampled plant depends on the actual analysis of the waste being treated and on the operating conditions at the time of sampling. Although EPA would not plan to sample a facility that was not ostensibly well-designed and well-operated, there is no way to ensure that at the time of the sampling the facility will not experience operating problems. Additionally, EPA statistically compares its test data to suitable industry-provided data, where available, in its determination of what data to use in developing treatment standards. The methodology for comparing data is presented later in this section.

(Note: Facilities wishing to submit data for consideration in the development of BDAT standards should, to the extent possible, provide sampling information similar to that acquired by EPA. Such facilities should review the Generic Quality Assurance Project Plan for the Land Disposal Restriction Program ("BDAT"), which delineates all of the quality control and quality assurance measures associated with sampling and analysis. Quality assurance and quality control procedures are summarized in Section 1.2.6 of this document.)

(4) <u>Sampling Visit</u>. The purpose of the sampling visit is to collect samples that characterize the performance of the treatment system and to document the operating conditions that existed during the waste treatment period. At a minimum, the Agency attempts to collect sufficient samples of the untreated waste and solid and liquid treatment residuals so that variability in the treatment process can be accounted for in the development of the treatment standards. To the extent practicable, and within safety constraints, EPA or its contractors collect all samples and ensure that chain-of-custody procedures are conducted so that the integrity of the data is maintained.

In general, the samples collected during the sampling visit will have already been specified in the SAP. In some instances, however, EPA will not be able to collect all planned samples because of changes in the facility operation or plant upsets; EPA will explain any such deviations from the SAP in its follow-up Onsite Engineering Report.

(5)  Onsite Engineering Report.  EPA summarizes all its data

collection activities and associated analytical results for testing at a

facility in a report referred to as the Onsite Engineering Report (OER).

This report characterizes the waste(s) treated, the treated residual

concentrations, the design and operating data, and all analytical results

including methods used and accuracy results.  This report also describes

any deviations from EPA's suggested analytical methods for hazardous

wastes (Test Methods for Evaluating Solid Waste, SW-846, Third Edition,

November 1986).

After the Onsite Engineering Report is completed, the report is

submitted to the plant for review.  This review provides the plant with a

final opportunity to claim any information contained in the report as

confidential.  Following the review and incorporation of comments, as

appropriate, the report is made available to the public with the

exception of any material claimed as confidential by the plant.

1.2.4  Hazardous Constituents Considered and Selected for Regulation

(1)  Development of BDAT List.  The list of hazardous constituents

within the waste codes that are targeted for treatment is referred to by

the Agency as the BDAT constituent list.  This list, provided as Table

1-1, is derived from the constituents presented in 40 CFR Part 261,

Appendix VII and Appendix VIII, as well as several ignitable constituents

used as the basis of listing wastes as F003 and F005.  These sources

provide a comprehensive list of hazardous constituents specifically

regulated under RCRA.  The BDAT list consists of those constituents that

can be analyzed using methods published in SW-846, Third Edition.

Table 1-1  BDAT Constituent List

| BDAT reference no. | Parameter | CAS no. |
|---|---|---|
| | Volatiles | |
| 222 | Acetone | 67-64-1 |
| 1 | Acetonitrile | 75-05-8 |
| 2 | Acrolein | 107-02-8 |
| 3 | Acrylonitrile | 107-13-1 |
| 4 | Benzene | 71-43-2 |
| 5 | Bromodichloromethane | 75-27-4 |
| 6. | Bromomethane | 74-83-9 |
| 223. | n-Butyl alcohol | 71-36-3 |
| 7. | Carbon tetrachloride | 56-23-5 |
| 8 | Carbon disulfide | 75-15-0 |
| 9 | Chlorobenzene | 108-90-7 |
| 10. | 2-Chloro-1,3-butadiene | 126-99-8 |
| 11. | Chlorodibromomethane | 124-48-1 |
| 12 | Chloroethane | 75-00-3 |
| 13 | 2-Chloroethyl vinyl ether | 110-75-8 |
| 14. | Chloroform | 67-66-3 |
| 15. | Chloromethane | 74-87-3 |
| 16. | 3-Chloropropene | 107-05-1 |
| 17. | 1,2-Dibromo-3-chloropropane | 96-12-8 |
| 18 | 1,2-Dibromoethane | 106-93-4 |
| 19. | Dibromomethane | 74-95-3 |
| 20. | Trans-1,4-Dichloro-2-butene | 110-57-6 |
| 21. | Dichlorodifluoromethane | 75-71-8 |
| 22 | 1,1-Dichloroethane | 75-34-3 |
| 23 | 1,2-Dichloroethane | 107-06-2 |
| 24 | 1,1-Dichloroethylene | 75-35-4 |
| 25 | Trans-1,2-Dichloroethene | 156-60-5 |
| 26 | 1,2-Dichloropropane | 78-87-5 |
| 27. | Trans-1,3-Dichloropropene | 10061-02-6 |
| 28. | cis-1,3-Dichloropropene | 10061-01-5 |
| 29 | 1,4-Dioxane | 123-91-1 |
| 224 | 2-Ethoxyethanol | 110-80-5 |
| 225. | Ethyl acetate | 141-78-6 |
| 226 | Ethyl benzene | 100-41-4 |
| 30 | Ethyl cyanide | 107-12-0 |
| 227 | Ethyl ether | 60-29-7 |
| 31 | Ethyl methacrylate | 97-63-2 |
| 214 | Ethylene oxide | 75-21-8 |
| 32 | Iodomethane | 74-88-4 |

Table 1-1 (continued)

| BDAT reference no. | Parameter | CAS no. |
|---|---|---|
| | Volatiles (continued) | |
| 33 | Isobutyl alcohol | 78-83-1 |
| 228 | Methanol | 67-56-1 |
| 34 | Methyl ethyl ketone | 78-93-3 |
| 229 | Methyl isobutyl ketone | 108-10-1 |
| 35. | Methyl methacrylate | 80-62-6 |
| 37 | Methacrylonitrile | 126-98-7 |
| 38. | Methylene chloride | 75-09-2 |
| 230. | 2-Nitropropane | 79-46-9 |
| 39. | Pyridine | 110-86-1 |
| 40 | 1,1,1,2-Tetrachloroethane | 630-20-6 |
| 41. | 1,1,2,2-Tetrachloroethane | 79-34-6 |
| 42. | Tetrachloroethene | 127-18-4 |
| 43 | Toluene | 108-88-3 |
| 44. | Tribromomethane | 75-25-2 |
| 45. | 1,1,1-Trichloroethane | 71-55-6 |
| 46. | 1,1,2-Trichloroethane | 79-00-5 |
| 47 | Trichloroethene | 79-01-6 |
| 48 | Trichloromonofluoromethane | 75-69-4 |
| 49 | 1,2,3-Trichloropropane | 96-18-4 |
| 231. | 1,1,2-Trichloro-1,2,2-trifluoro-ethane | 76-13-1 |
| 50 | Vinyl chloride | 75-01-4 |
| 215. | 1,2-Xylene | 97-47-6 |
| 216. | 1,3-Xylene | 108-38-3 |
| 217 | 1,4-Xylene | 106-44-5 |
| | Semivolatiles | |
| 51. | Acenaphthalene | 208-96-8 |
| 52 | Acenaphthene | 83-32-9 |
| 53 | Acetophenone | 96-86-2 |
| 54 | 2-Acetylaminofluorene | 53-96-3 |
| 55. | 4-Aminobiphenyl | 92-67-1 |
| 56 | Aniline | 62-53-3 |
| 57. | Anthracene | 120-12-7 |
| 58 | Aramite | 140-57-8 |
| 59 | Benz(a)anthracene | 56-55-3 |
| 218 | Benzal chloride | 98-87-3 |
| 60 | Benzenethiol | 108-98-5 |
| 61 | Deleted | |
| 62. | Benzo(a)pyrene | 50-32-8 |

Table 1-1   (continued)

| BDAT reference no. | Parameter | CAS no. |
|---|---|---|
| | Semivolatiles (continued) | |
| 63 | Benzo(b)fluoranthene | 205-99-2 |
| 64 | Benzo(ghi)perylene | 191-24-2 |
| 65 | Benzo(k)fluoranthene | 207-08-9 |
| 66 | p-Benzoquinone | 106-51-4 |
| 67 | Bis(2-chloroethoxy)methane | 111-91-1 |
| 68 | Bis(2-chloroethyl)ether | 111-44-4 |
| 69. | Bis(2-chloroisopropyl)ether | 39638-32-9 |
| 70. | Bis(2-ethylhexyl)phthalate | 117-81-7 |
| 71. | 4-Bromophenyl phenyl ether | 101-55-3 |
| 72 | Butyl benzyl phthalate | 85-68-7 |
| 73 | 2-sec-Butyl-4,6-dinitrophenol | 88-85-7 |
| 74. | p-Chloroaniline | 106-47-8 |
| 75 | Chlorobenzilate | 510-15-6 |
| 76 | p-Chloro-m-cresol | 59-50-7 |
| 77 | 2-Chloronaphthalene | 91-58-7 |
| 78 | 2-Chlorophenol | 95-57-8 |
| 79 | 3-Chloropropionitrile | 542-76-7 |
| 80 | Chrysene | 218-01-9 |
| 81 | ortho-Cresol | 95-48-7 |
| 82 | para-Cresol | 106-44-5 |
| 232 | Cyclohexanone | 108-94-1 |
| 83 | Dibenz(a,h)anthracene | 53-70-3 |
| 84 | Dibenzo(a,e)pyrene | 192-65-4 |
| 85 | Dibenzo(a,i)pyrene | 189-55-9 |
| 86 | m-Dichlorobenzene | 541-73-1 |
| 87 | o-Dichlorobenzene | 95-50-1 |
| 88 | p-Dichlorobenzene | 106-46-7 |
| 89 | 3,3'-Dichlorobenzidine | 91-94-1 |
| 90 | 2,4-Dichlorophenol | 120-83-2 |
| 91 | 2,6-Dichlorophenol | 87-65-0 |
| 92 | Diethyl phthalate | 84-66-2 |
| 93 | 3,3'-Dimethoxybenzidine | 119-90-4 |
| 94 | p-Dimethylaminoazobenzene | 60-11-7 |
| 95 | 3,3'-Dimethylbenzidine | 119-93-7 |
| 96 | 2,4-Dimethylphenol | 105-67-9 |
| 97. | Dimethyl phthalate | 131-11-3 |
| 98 | Di-n-butyl phthalate | 84-74-2 |
| 99 | 1,4-Dinitrobenzene | 100-25-4 |
| 100 | 4,6-Dinitro-o-cresol | 534-52-1 |
| 101 | 2,4-Dinitrophenol | 51-28-5 |

Table 1-1   (continued)

| BDAT reference no | Parameter | CAS no. |
|---|---|---|
| | Semivolatiles (continued) | |
| 102. | 2,4-Dinitrotoluene | 121-14-2 |
| 103 | 2,6-Dinitrotoluene | 606-20-2 |
| 104 | Di-n-octyl phthalate | 117-84-0 |
| 105. | Di-n-propylnitrosamine | 621-64-7 |
| 106 | Diphenylamine | 122-39-4 |
| 219. | Diphenylnitrosamine | 86-30-6 |
| 107 | 1,2-Diphenylhydrazine | 122-66-7 |
| 108. | Fluoranthene | 206-44-0 |
| 109 | Fluorene | 86-73-7 |
| 110. | Hexachlorobenzene | 118-74-1 |
| 111 | Hexachlorobutadiene | 87-68-3 |
| 112 | Hexachlorocyclopentadiene | 77-47-4 |
| 113 | Hexachloroethane | 67-72-1 |
| 114 | Hexachlorophene | 70-30-4 |
| 115 | Hexachloropropene | 1888-71-7 |
| 116. | Indeno(1,2,3-cd)pyrene | 193-39-5 |
| 117 | Isosafrole | 120-58-1 |
| 118. | Methapyrilene | 91-80-5 |
| 119. | 3-Methylcholanthrene | 56-49-5 |
| 120. | 4,4'-Methylenebis (2-chloroaniline) | 101-14-4 |
| 36 | Methyl methanesulfonate | 66-27-3 |
| 121 | Naphthalene | 91-20-3 |
| 122 | 1,4-Naphthoquinone | 130-15-4 |
| 123 | 1-Naphthylamine | 134-32-7 |
| 124 | 2-Naphthylamine | 91-59-8 |
| 125 | p-Nitroaniline | 100-01-6 |
| 126 | Nitrobenzene | 98-95-3 |
| 127 | 4-Nitrophenol | 100-02-7 |
| 128 | N-Nitrosodi-n-butylamine | 924-16-3 |
| 129. | N-Nitrosodiethylamine | 55-18-5 |
| 130 | N-Nitrosodimethylamine | 62-75-9 |
| 131 | N-Nitrosomethylethylamine | 10595-95-6 |
| 132 | N-Nitrosomorpholine | 59-89-2 |
| 133 | N-Nitrosopiperidine | 100-75-4 |
| 134 | n-Nitrosopyrrolidine | 930-55-2 |
| 135 | 5-Nitro-o-toluidine | 99-65-8 |
| 136 | Pentachlorobenzene | 608-93-5 |
| 137 | Pentachloroethane | 76-01-7 |
| 138 | Pentachloronitrobenzene | 82-68-8 |

Table 1-1 (continued)

| BDAT reference no | Parameter | CAS no. |
|---|---|---|
| | Semivolatiles (continued) | |
| 139 | Pentachlorophenol | 87-86-5 |
| 140 | Phenacetin | 62-44-2 |
| 141. | Phenanthrene | 85-01-8 |
| 142 | Phenol | 108-95-2 |
| 220. | Phthalic anhydride | 85-44-9 |
| 143 | 2-Picoline | 109-06-8 |
| 144 | Pronamide | 23950-58-5 |
| 145. | Pyrene | 129-00-0 |
| 146. | Resorcinol | 108-46-3 |
| 147. | Safrole | 94-59-7 |
| 148 | 1,2,4,5-Tetrachlorobenzene | 95-94-3 |
| 149. | 2,3,4,6-Tetrachlorophenol | 58-90-2 |
| 150. | 1,2,4-Trichlorobenzene | 120-82-1 |
| 151 | 2,4,5-Trichlorophenol | 95-95-4 |
| 152. | 2,4,6-Trichlorophenol | 88-06-2 |
| 153. | Tris(2,3-dibromopropyl) phosphate | 126-72-7 |
| | Metals | |
| 154. | Antimony | 7440-36-0 |
| 155 | Arsenic | 7440-38-2 |
| 156 | Barium | 7440-39-3 |
| 157 | Beryllium | 7440-41-7 |
| 158. | Cadmium | 7440-43-9 |
| 159. | Chromium (total) | 7440-47-32 |
| 221. | Chromium (hexavalent) | - |
| 160. | Copper | 7440-50-8 |
| 161 | Lead | 7439-92-1 |
| 162. | Mercury | 7439-97-6 |
| 163. | Nickel | 7440-02-0 |
| 164 | Selenium | 7782-49-2 |
| 165 | Silver | 7440-22-4 |
| 166. | Thallium | 7440-28-0 |
| 167 | Vanadium | 7440-62-2 |
| 168. | Zinc | 7440-66-6 |
| | Inorganics | |
| 169 | Cyanide | 57-12-5 |
| 170. | Fluoride | 16964-48-8 |
| 171. | Sulfide | 8496-25-8 |

Table 1-1   (continued)

| BDAT reference no | Parameter | CAS no. |
|---|---|---|
| | **Organochlorine pesticides** | |
| 172 | Aldrin | 309-00-2 |
| 173. | alpha-BHC | 319-84-6 |
| 174 | beta-BHC | 319-85-7 |
| 175 | delta-BHC | 319-86-8 |
| 176 | gamma-BHC | 58-89-9 |
| 177 | Chlordane | 57-74-9 |
| 178. | DDD | 72-54-8 |
| 179 | DDE | 72-55-9 |
| 180 | DDT | 50-29-3 |
| 181. | Dieldrin | 60-57-1 |
| 182 | Endosulfan I | 939-98-8 |
| 183. | Endosulfan II | 33213-6-5 |
| 184. | Endrin | 72-20-8 |
| 185. | Endrin aldehyde | 7421-93-4 |
| 186. | Heptachlor | 76-44-8 |
| 187. | Heptachlor epoxide | 1024-57-3 |
| 188. | Isodrin | 465-73-6 |
| 189 | Kepone | 143-50-0 |
| 190 | Methoxyclor | 72-43-5 |
| 191 | Toxaphene | 8001-35-2 |
| | **Phenoxyacetic acid herbicides** | |
| 192. | 2,4-Dichlorophenoxyacetic acid | 94-75-7 |
| 193. | Silvex | 93-72-1 |
| 194. | 2,4,5-T | 93-76-5 |
| | **Organophosphorous insecticides** | |
| 195. | Disulfoton | 298-04-4 |
| 196. | Famphur | 52-85-7 |
| 197 | Methyl parathion | 298-00-0 |
| 198. | Parathion | 56-38-2 |
| 199 | Phorate | 298-02-2 |
| | **PCBs** | |
| 200. | Aroclor 1016 | 12674-11-2 |
| 201. | Aroclor 1221 | 11104-28-2 |
| 202 | Aroclor 1232 | 11141-16-5 |

Table 1-1   (continued)

| BDAT reference no | Parameter | CAS no. |
|---|---|---|
| | PCBs (continued) | |
| 203. | Aroclor 1242 | 53469-21-9 |
| 204 | Aroclor 1248 | 12672-29-6 |
| 205 | Aroclor 1254 | 11097-69-1 |
| 206 | Aroclor 1260 | 11096-82-5 |
| | Dioxins and furans | |
| 207 | Hexachlorodibenzo-p-dioxins | - |
| 208. | Hexachlorodibenzofurans | - |
| 209. | Pentachlorodibenzo-p-dioxins | - |
| 210 | Pentachlorodibenzofurans | - |
| 211 | Tetrachlorodibenzo-p-dioxins | - |
| 212 | Tetrachlorodibenzofurans | - |
| 213 | 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 |

The initial BDAT constituent list was published in EPA's Generic
Quality Assurance Project Plan, March 1987 (EPA/530-SW-87-011).
Additional constituents will be added to the BDAT constituent list as
additional key constituents are identified for specific waste codes or as
new analytical methods are developed for hazardous constituents. For
example, since the list was published in March 1987, eighteen additional
constituents (hexavalent chromium, xylene (all three isomers), benzal
chloride, phthalic anhydride, ethylene oxide, acetone, n-butyl alcohol,
2-ethoxyethanol, ethyl acetate, ethyl benzene, ethyl ether, methanol,
methyl isobutyl ketone, 2-nitropropane, 1,1,2-trichloro-1,2,2-
trifluoroethane, and cyclohexanone) have been added to the list.

Chemicals are listed in Appendix VIII if they are shown in scientific
studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on
humans or other life-forms, and they include such substances as those
identified by the Agency's Carcinogen Assessment Group as being
carcinogenic. Including a constituent in Appendix VIII means that the
constituent can be cited as a basis for listing toxic wastes.

Although Appendix VII, Appendix VIII, and the F003 and F005
ignitables provide a comprehensive list of RCRA-regulated hazardous
constituents, not all of the constituents can be analyzed in a complex
waste matrix. Therefore, constituents that could not be readily analyzed
in an unknown waste matrix were not included on the initial BDAT list.
As mentioned above, however, the BDAT constituent list is a continuously
growing list that does not preclude the addition of new constituents when
analytical methods are developed.

There are 5 major reasons that constituents were not included on the BDAT constituent list:

(a) Constituents are unstable. Based on their chemical structure, some constituents will either decompose in water or will ionize. For example, maleic anhydride will form maleic acid when it comes in contact with water and copper cyanide will ionize to form copper and cyanide ions. However, EPA may choose to regulate the decomposition or ionization products.

(b) EPA-approved or verified analytical methods are not available. Many constituents, such as 1,3,5-trinitrobenzene, are not measured adequately or even detected using any of EPA's analytical methods published in SW-846 Third Edition.

(c) The constituent is a member of a chemical group designated in Appendix VIII as not otherwise specified (N.O.S.). Constituents listed as N.O.S., such as chlorinated phenols, are a generic group of some types of chemicals for which a single analytical procedure is not available. The individual members of each such group need to be listed to determine whether the constituents can be analyzed. For each N.O.S. group, all those constituents that can be readily analyzed are included in the BDAT constituents list.

(d) Available analytical procedures are not appropriate for a complex waste matrix. Some compounds, such as auramine, can be analyzed as a pure constituent. However, in the presence of other constituents, the recommended analytical method does not positively identify the constituent. The use of high pressure liquid chromotography (HPLC) presupposes a high expectation of finding the specific constituents of interest. In using this procedure to screen samples, protocols would have to be developed on a case-specific basis to verify the identity of constituents present in the samples. Therefore, HPLC is not an appropriate analytical procedure for complex samples containing unkown constituents.

(e) Standards for analytical instrument calibration are not commercially available. For several constituents, such as benz(c)acridine, commercially available standards of a "reasonably" pure grade are not available. The unavailability of a standard was determined by a review of catalogs from specialty chemical manufacturers.

Two constituents (fluoride and sulfide) are not specifically included in Appendices VII and VIII; however, these compounds are included on the BDAT list as indicator constituents for compounds from Appendices VII and VIII such as hydrogen fluoride and hydrogen sulfide, which ionize in water.

The BDAT constituent list presented in Table 1-1 is divided into the following nine groups:

- Volatile organics
- Semivolatile organics
- Metals
- Other inorganics
- Organochlorine pesticides
- Phenoxyacetic acid herbicides
- Organophosphorous insecticides
- PCBs
- Dioxins and furans

The constituents were placed in these categories based on their chemical properties. The constituents in each group are expected to behave similarily during treatment and are also analyzed, with the exception of the metals and inorganics, by using the same analytical methods.

(2) Constituent Selection Analysis. The constituents that the Agency selects for regulation in each treatability group are, in general, those found in the untreated wastes at treatable concentrations. For certain waste codes, the target list for the untreated waste may have been shortened (relative to analyses performed to test treatment technologies) because of the extreme unlikelihood of the constituent being present.

In selecting constituents for regulation, the first step is to summarize all the constituents that were found in the untreated waste at treatable concentrations. This process involves the use of the statistical analysis of variance (ANOVA) test, described in Section 1.2.6, to determine if constituent reductions were significant. The Agency interprets a significant reduction in concentration as evidence that the technology actually "treats" the waste.

There are some instances where EPA may regulate constituents that are not found in the untreated waste but are detected in the treated residual. This is generally the case where presence of the constituents in the untreated waste interferes with the quantification of the constituent of concern. In such instances, the detection levels of the constituent are relatively high, resulting in a finding of "not detected" when, in fact, the constituent is present in the waste.

After determining which of the constituents in the untreated waste are present at treatable concentrations, EPA develops a list of potential constituents for regulation. The Agency then reviews this list to determine if any of these constituents can be excluded from regulation because they would be controlled by regulation of other constituents in the list.

EPA performs this indicator analysis for two reasons: (1) it reduces the analytical cost burdens on the treater and (2) it facilitates implementation of the compliance and enforcement program. EPA's rationale for selection of regulated constituents for this waste code is presented in Section 5 of this background document.

(3) <u>Calculation of Standards</u>. The final step in the calculation of the BDAT treatment standard is the multiplication of the average treatment value by a factor referred to by the Agency as the variability factor. This calculation takes into account that even well-designed and well-operated treatment systems will experience some fluctuations in performance. EPA expects that fluctuations will result from inherent mechanical limitations in treatment control systems, collection of treated samples, and analysis of these samples. All of the above fluctuations can be expected to occur at well-designed and well-operated treatment facilities. Therefore, setting treatment standards utilizing a variability factor should be viewed not as a relaxing of 3004(m) requirements, but rather as a function of the normal variability of the treatment processes. A treatment facility will have to be designed to meet the mean achievable treatment performance level to ensure that the performance levels remain within the limits of the treatment standard.

The Agency calculates a variability factor for each constituent of concern within a waste treatability group using the statistical calculation presented in Appendix A. The equation for calculating the variability factor is the same as that used by EPA for the development of numerous regulations in the Effluent Guidelines Program under the Clean Water Act. The variability factor establishes the instantaneous maximum based on the 99th percentile value.

There is an additional step in the calculation of the treatment standards in those instances where the ANOVA analysis shows that more

than one technology achieves a level of performance that represents BDAT. In such instances, the BDAT treatment standard is calculated by first averaging the mean performance value for each technology for each constituent of concern and then multiplying that value by the highest variability factor among the technologies considered. This procedure ensures that all the BDAT technologies used as the basis for the standards will achieve full compliance.

1.2.5   Compliance with Performance Standards

All the treatment standards reflect performance achieved by the Best Demonstrated Available Technology (BDAT). As such, compliance with these standards only requires that the treatment level be achieved prior to land disposal. It does not require the use of any particular treatment technology. While dilution of the waste as a means to comply with the standard is prohibited, wastes that are generated in such a way as to naturally meet the standard can be land disposed without treatment. With the exception of treatment standards that prohibit land disposal, all treatment standards proposed are expressed as a concentration level.

EPA has used both total constituent concentration and TCLP analyses of the treated waste as a measure of technology performance. EPA's rationale for when each of these analytical tests is used is explained in the following discussion.

For all organic constituents, EPA is basing the treatment standards on the total constituent concentration found in the treated waste. EPA based its decision on the fact that technologies exist to destroy the

various organics compounds. Accordingly, the best measure of performance would be the extent to which the various organic compounds have been destroyed or the total amount of constituent remaining after treatment. (NOTE: EPA's land disposal restrictions for solvent waste codes F001-F005 (51 FR 40572) uses the TCLP value as a measure of performance. At the time that EPA promulgated the treatment standards for F001-F005, useful data were not available on total constituent concentrations in treated residuals and, as a result, the TCLP data were considered to be the best measure of performance.)

For all metal constituents, EPA is using both total constituent concentration and/or the TCLP as the basis for treatment standards. The total constituent concentration is being used when the technology basis includes a metal recovery operation. The underlying principle of metal recovery is the reduction of the amount of metal in a waste by separating the metal for recovery; therefore, total constituent concentration in the treated residual is an important measure of performance for this technology. Additionally, EPA also believes that it is important that any remaining metal in a treated residual waste not be in a state that is easily leachable; accordingly, EPA is also using the TCLP as a measure of performance. It is important to note that for wastes for which treatment standards are based on a metal recovery process, the facility has to comply with both the total constituent concentration and the TCLP prior to land disposal.

In cases where treatment standards for metals are not based on recovery techniques but rather on stabilization, EPA is using only the TCLP as a measure of performance. The Agency's rationale is that stabilization is not meant to reduce the concentration of metal in a waste but only to chemically minimize the ability of the metal to leach.

1.2.6    Identification of BDAT

(1)    Screening of Treatment Data. This section explains how the Agency determines which of the treatment technologies represent treatment by BDAT. The first activity is to screen the treatment performance data from each of the demonstrated and available technologies according to the following criteria:

(a)    Design and operating data associated with the treatment data must reflect a well-designed, well-operated system for each treatment data point. (The specific design and operating parameters for each demonstrated technology for this waste code are discussed in Section 3.4 of this document.)

(b)    Sufficient QA/QC data must be available to determine the true values of the data from the treated waste. This screening criterion involves adjustment of treated data to take into account that the type value may be different from the measured value. This discrepancy generally is caused by other constituents in the waste that can mask results or otherwise interfere with the analysis of the constituent of concern.

(c)    The measure of performance must be consistent with EPA's approach to evaluating treatment by type of constituents (e.g., total concentration data for organics, and total concentration and TCLP for metals in the leachate from the residual).

In the absence of data needed to perform the screening analysis, EPA will make decisions on a case-by-case basis of whether to include the data. The factors included in this case-by-case analysis will be the

actual treatment levels achieved, the availability of the treatment data and their completeness (with respect to the above criteria), and EPA's assessment of whether the untreated waste represents the waste code of concern. EPA's application of these screening criteria for this waste code are provided in Section 4 of this background document.

(2) <u>Comparison of Treatment Data</u>. In cases in which EPA has treatment data from more than one technology following the screening activity, EPA uses the statistical method known as analysis of variance (ANOVA) to determine if one technology performs significantly better. This statistical method (summarized in Appendix A) provides a measure of the differences between two data sets. If EPA finds that one technology performs significantly better (i.e., the data sets are not homogeneous), BDAT treatment standards are the level of performance achieved by the best technology multiplied by the corresponding variability factor for each regulated constituent.

If the differences in the data sets are not statistically significant, the data sets are said to be homogeneous. Specifically, EPA uses the analysis of variance to determine whether BDAT represents a level of performance achieved by only one technology or represents a level of performance achieved by more than one (or all) of the technologies. If the Agency finds that the levels of performance for one or more technologies are not statistically different, EPA averages the performance values achieved by each technology and then multiplies this value by the largest variability factor associated with any of the

acceptable technologies. A detailed discussion of the treatment selection method and an example of how EPA chooses BDAT from multiple treatment systems is provided in Section A-1.

(3) <u>Quality Assurance/Quality Control</u>. This section presents the principal quality assurance/quality control (QA/QC) procedures employed in screening and adjusting the data to be used in the calculation of treatment standards. Additional QA/QC procedures used in collecting and screening data for the BDAT program are presented in EPA's Generic Quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT") (EPA/530-SW-87-001, March 1987).

To calculate the treatment standards for the Land Disposal Restriction Rules, it is first necessary to determine the recovery value for each constituent (the amount of constituent recovered after spiking, which is the addition of a known amount of the constituent, minus the initial concentration in the samples divided by the amount added) for a spike of the treated residual. Once the recovery value is determined, the following procedures are used to select the appropriate percent recovery value to adjust the analytical data:

(a) If duplicate spike recovery values are available for the constituent of interest, the data are adjusted by the lowest available percent recovery value (i.e., the value that will yield the most conservative estimate of treatment achieved). However, if a spike recovery value of less than 20 percent is reported for a specific constituent, the data are not used to set treatment standards because the Agency does not have sufficient confidence in the reported value to set a national standard.

(b) If data are not available for a specific constituent but are available for an isomer, then the spike recovery data are transferred from the isomer and the data are adjusted using the percent recovery selected according to the procedure described in (a) above.

(c) If data are not available for a specific constituent but are available for a similar class of constituents (e.g., volatile organics, acid-extractable semivolatiles), then spike recovery data available for this class of constituents are transferred. All spike recovery values greater than or equal to 20 percent for a spiked sample are averaged and the constituent concentration is adjusted by the average recovery value. If spiked recovery data are available for more than one sample, the average is calculated for each sample and the data are adjusted by the lowest average value.

(d) If matrix spike recovery data are not available for a set of data to be used to calculate treatment standards, then matrix spike recovery data are transferred from a waste that the Agency believes is a similar matrix (e.g., if the data are for an ash from incineration, then data from other incinerator ashes could be used). While EPA recognizes that transfer of matrix spike recovery data from a similar waste is not an exact analysis, this is considered the best approach for adjusting the data to account for the fact that most analyses do not result in extraction of 100 percent of the constituent. In assessing the recovery data to be transferred, the procedures outlined in (a), (b), and (c) above are followed.

The analytical procedures employed to generate the data used to calculate the treatment standards are listed in Appendix D of this document. In cases where alternatives or equivalent procedures and/or equipment are allowed in EPA's SW-846, Third Edition (November 1986) methods, the specific procedures and equipment used are also documented in this Appendix. In addition, any deviations from the SW-846, Third Edition, methods used to analyze the specific waste matrices are documented. It is important to note that the Agency will use the methods and procedures delineated in Appendix D to enforce the treatment

standards presented in Section 6 of this document. Accordingly, facilities should use these procedures in assessing the performance of their treatment systems.

1.2.7 BDAT Treatment Standards for "Derived-From" and "Mixed" Wastes

(1) <u>Wastes from Treatment Trains Generating Multiple Residues</u>. In a number of instances, the proposed BDAT consists of a series of operations each of which generates a waste residue. For example, the proposed BDAT for a certain waste code is based on solvent extraction, steam stripping, and activated carbon adsorption. Each of these treatment steps generates a waste requiring treatment -- a solvent-containing stream from solvent extraction, a stripper overhead, and spent activated carbon. Treatment of these wastes may generate further residues; for instance, spent activated carbon (if not regenerated) could be incinerated, generating an ash and possibly a scrubber water waste. Ultimately, additional wastes are generated that may require land disposal. With respect to these wastes, the Agency wishes to emphasize the following points:

(a) All of the residues from treating the original listed wastes are likewise considered to be the listed waste by virtue of the derived-from rule contained in 40 CFR Part 261.3(c)(2). (This point is discussed more fully in (2) below.) Consequently, all of the wastes generated in the course of treatment would be prohibited from land disposal unless they satisfy the treatment standard or meet one of the exceptions to the prohibition.

(b) The Agency's proposed treatment standards generally contain a concentration level for wastewaters and a concentration level for nonwastewaters. The treatment standards apply to all of the wastes generated in treating the original prohibited waste. Thus, all solids generated from treating these wastes would have

to meet the treatment standard for nonwastewaters. All derived-from wastes meeting the Agency definition of wastewater (less than 1 percent TOC and less than 1 percent total filterable solids) would have to meet the treatment standard for wastewaters. EPA wishes to make clear that this approach is not meant to allow partial treatment in order to comply with the applicable standard.

(c) The Agency has not performed tests, in all cases, on every waste that can result from every part of the treatment train. However, the Agency's treatment standards are based on treatment of the most concentrated form of the waste. Consequently, the Agency believes that the less concentrated wastes generated in the course of treatment will also be able to be treated to meet this value.

(2) <u>Mixtures and Other Derived-From Residues</u>. There is a further question as to the applicability of the BDAT treatment standards to residues generated not from treating the waste (as discussed above), but from other types of management. Examples are contaminated soil or leachate that is derived from managing the waste. In these cases, the mixture is still deemed to be the listed waste, either because of the derived-from rule (40 CFR Part 261.3(c)(2)(i)) or the mixture rule (40 CFR Part 261.3(a)(2)(iii) and (iv) or because the listed waste is contained in the matrix (see, for example, 40 CFR Part 261.33(d)). The prohibition for the particular listed waste consequently applies to this type of waste.

The Agency believes that the majority of these types of residues can meet the treatment standards for the underlying listed wastes (with the possible exception of contaminated soil and debris for which the Agency is currently investigating whether it is appropriate to establish a separate treatability subcategorization). For the most part, these

residues will be less concentrated than the original listed waste. The Agency's treatment standards also make a generous allowance for process variability by assuming that all treatability values used to establish the standard are lognormally distributed. The waste also might be amenable to a relatively nonvariable form of treatment technology such as incineration. Finally, and perhaps most important, the rules contain a treatability variance that allows a petitioner to demonstrate that its waste cannot be treated to the level specified in the rule (40 CFR Part 268.44(a). This provision provides a safety valve that allows persons with unusual waste matrices to demonstrate the appropriateness of a different standard. The Agency, to date, has not received any petitions under this provision (for example, for residues contaminated with a prohibited solvent waste), indicating, in the Agency's view, that the existing standards are generally achievable.

(3) Residues from Managing Listed Wastes or that Contain Listed

Wastes. The Agency has been asked if and when residues from managing hazardous wastes, such as leachate and contaminated ground water, become subject to the land disposal prohibitions. Although the Agency believes this question to be settled by existing rules and interpretative statements, to avoid any possible confusion the Agency will address the question again.

Residues from managing First Third wastes, listed California List wastes, and spent solvent and dioxin wastes are all considered to be subject to the prohibitions for the underlying hazardous waste. Residues

from managing California List wastes likewise are subject to the California List prohibitions when the residues themselves exhibit a characteristic of hazardous waste. This determination stems directly from the derived-from rule in 40 CFR Part 261.3(c)(2) or in some cases from the fact that the waste is mixed with or otherwise contains the listed waste. The underlying principle stated in all of these provisions is that listed wastes remain listed until delisted.

The Agency's historic practice in processing delisting petitions addressing mixing residuals has been to consider them to be the listed waste and to require that delisting petitioners address all constituents for which the derived-from waste (or other mixed waste) was listed. The language in 40 CFR Part 260.22(b) states that mixtures or derived-from residues can be delisted provided a delisting petitioner makes a demonstration identical to that which a delisting petitioner would make for the underlying waste. These residues consequently are treated as the underlying listed waste for delisting purposes. The statute likewise takes this position, indicating that soil and debris that are contaminated with listed spent solvents or dioxin wastes are subject to the prohibition for these wastes even though these wastes are not the originally generated waste, but rather are a residual from management (RCRA section 3004(e)(3)). It is EPA's view that all such residues are covered by the existing prohibitions and treatment standards for the listed hazardous waste that these residues contain and from which they are derived.

## 1.2.8 Transfer of Treatment Standards

EPA is proposing some treatment standards that are not based on testing of the treatment technology of the specific waste subject to the treatment standard. Instead, the Agency has determined that the constituents present in the subject waste can be treated to the same performance levels as those observed in other wastes for which EPA has previously developed treatment data. EPA believes that transferring treatment performance for use in establishing treatment standards for untested wastes is valid technically in cases where the untested wastes are generated from similar industries, similar processing steps, or have similar waste characteristics affecting performance and treatment selection. Transfer of treatment standards to similar wastes or wastes from similar processing steps requires little formal analysis. However, in the case where only the industry is similar, EPA more closely examines the waste characteristics prior to concluding that the untested waste constituents can be treated to levels associated with tested wastes.

EPA undertakes a two-step analysis when determining whether wastes generated by different processes within a single industry can be treated to the same level of performance. First, EPA reviews the available waste characteristic data to identify those parameters that are expected to affect treatment selection. EPA has identified some of the most important constituents and other parameters needed to select the treatment technology appropriate for a given waste. A detailed discussion of each analysis, including how each parameter was selected for each waste, can be found in the background document for each waste.

Second, when an individual analysis suggests that an untested waste can be treated with the same technology as a waste for which treatment performance data are already available, EPA analyzes a more detailed list of constituents that represent some of the most important waste characteristics that the Agency believes will affect the performance of the technology. By examining and comparing these characteristics, the Agency determines whether the untested wastes will achieve the same level of treatment as the tested waste. Where the Agency determines that the untested waste is easier to treat than the tested waste, the treatment standards can be transferred. A detailed discussion of this transfer process for each waste can be found in later sections of this document.

1.3  Variance from the BDAT Treatment Standard

The Agency recognizes that there may exist unique wastes that cannot be treated to the level specified as the treatment standard. In such a case, a generator or owner/operator may submit a petition to the Administrator requesting a variance from the treatment standard. A particular waste may be significantly different from the wastes considered in establishing treatability groups because the waste contains a more complex matrix that makes it more difficult to treat. For example, complex mixtures may be formed when a restricted waste is mixed with other waste streams by spills or other forms of inadvertent mixing. As a result, the treatability of the restricted waste may be altered such that it cannot meet the applicable treatment standard.

Variance petitions must demonstrate that the treatment standard established for a given waste cannot be met. This demonstration can be

made by showing that attempts to treat the waste by available technologies were not successful or by performing appropriate analyses of the waste, including waste characteristics affecting performance, which demonstrate that the waste cannot be treated to the specified levels. Variances will not be granted based solely on a showing that adequate BDAT treatment capacity is unavailable. (Such demonstrations can be made according to the provisions in Part 268.5 of RCRA for case-by-case extensions of the effective date.) The Agency will consider granting generic petitions provided that representative data are submitted to support a variance for each facility covered by the petition.

Petitioners should submit at least one copy to:

The Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC  20460

An additional copy marked "Treatability Variance" should be submitted to:

Chief, Waste Treatment Branch
Office of Solid Waste (WH-565)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC  20460

Petitions containing confidential information should be sent with only the inner envelope marked "Treatability Variance" and "Confidential Business Information" and with the contents marked in accordance with the requirements of 40 CFR Part 2 (41 FR 36902, September 1, 1976, amended by 43 FR 4000).

The petition should contain the following information:

(1) The petitioner's name and address.

(2) A statement of the petitioner's interest in the proposed action.

(3) The name, address, and EPA identification number of the facility generating the waste, and the name and telephone number of the plant contact.

(4) The process(es) and feed materials generating the waste and an assessment of whether such process(es) or feed materials may produce a waste that is not covered by the demonstration.

(5) A description of the waste sufficient for comparison with the waste considered by the Agency in developing BDAT, and an estimate of the average and maximum monthly and annual quantities of waste covered by the demonstration. (Note: The petitioner should consult the appropriate BDAT background document for determining the characteristics of the wastes considered in developing treatment standards.)

(6) If the waste has been treated, a description of the system used for treating the waste, including the process design and operating conditions. The petition should include the reasons the treatment standards are not achievable and/or why the petitioner believes the standards are based on inappropriate technology for treating the waste. (Note: The petitioner should refer to the BDAT background document as guidance for determining the design and operating parameters that the Agency used in developing treatment standards.)

(7) A description of the alternative treatment systems examined by the petitioner (if any); a description of the treatment system deemed appropriate by the petitioner for the waste in question; and, as appropriate, the concentrations in the treatment residual or extract of the treatment residual (i.e., using the TCLP where appropriate for stabilized metals) that can be achieved by applying such treatment to the waste.

(8) A description of those parameters affecting treatment selection and waste characteristics that affect performance, including results of all analyses. (See Section 3.0 for a discussion of waste characteristics affecting performance that the Agency has identified for the technology representing BDAT.)

(9) The dates of the sampling and testing.

(10) A description of the methodologies and equipment used to obtain representative samples.

(11) A description of the sample handling and preparation techniques, including techniques used for extraction, containerization, and preservation of the samples.

(12) A description of analytical procedures used including QA/QC methods.

After receiving a petition for a variance, the Administrator may request any additional information or waste samples that may be required to evaluate and process the petition. Additionally, all petitioners must certify that the information provided to the Agency is accurate under 40 CFR Part 268.4(b).

In determining whether a variance will be granted, the Agency will first look at the design and operation of the treatment system being used. If EPA determines that the technology and operation are consistent with BDAT, the Agency will evaluate the waste to determine if the waste matrix and/or physical parameters are such that the BDAT treatment standards reflect treatment of this waste. Essentially, this latter analysis will concern the parameters affecting treatment selection and waste characteristics affecting performance parameters.

In cases where BDAT is based on more than one technology, the petitioner will need to demonstrate that the treatment standard cannot be met using any of the technologies, or that none of the technologies are appropriate for treatment of the waste. After the Agency has made a determination on the petition, the Agency's findings will be published in the Federal Register, followed by a 30-day period for public comment.

After review of the public comments, EPA will publish its final determination in the Federal Register as an amendment to the treatment standards in 40 CFR Part 268, Subpart D.

## 2.0 INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

As described in Section 1.0, the Hazardous and Solid Waste Amendments (HSWA) specify dates when particular groups of hazardous wastes are prohibited from land disposal. The amendments also require the Environmental Protection Agency to establish treatment standards for each waste that, when met, allow that waste to be land disposed. Wastes listed as K016, K018, K020, and K030, that are generated by the production of chlorinated organic chemicals, are part of the first third of listed wastes to be evaluated by the Agency. K019 is also generated by the production of chlorinated organic chemicals. K019 was originally scheduled for regulation with the second third of listed wastes; however, the Agency has chosen to include K019 in this waste treatability group due to the similarity between K019 and the other chlorinated organic wastes. The purpose of this section is to describe the industry affected by the land disposal restrictions for K016, K018, K019, K020, and K030 and to present available characterization data for these wastes.

Under 40 CFR 261.32 (hazardous wastes from specific sources), wastes identified as K016, K018, K019, K020, and K030 are specifically generated in the production of chlorinated organic chemicals and are listed as follows:

K016: Heavy ends or distillation residues from the production of carbon tetrachloride

K018: Heavy ends from the fractionation column in ethyl chloride production

K019: Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production

K020:    Heavy ends from the distillation of vinyl chloride in
         vinyl chloride monomer production

K030:    Column bottoms or heavy ends from the combined production
         of trichloroethylene and perchloroethylene

The Agency has determined that these listed wastes (K016, K018, K019, K020, and K030) represent a single waste treatability group based on their similar physical and chemical characteristics. As described later in this section, EPA has examined the sources of the wastes, the specific similarities in waste composition, applicable and demonstrated treatment technologies, and attainable treatment performance in order to support a simplified regulatory approach for these five chlorinated organic chemicals wastes.


2.1    Industry Affected and Process Description


The four digit standard industrial classification (SIC) code associated with the production of chlorinated organic chemicals is 2869 (Industrial Organic Chemicals, Not Elsewhere Classified). The Agency estimates that there are 7 facilities that produce K016, 5 facilities that produce K018, 16 facilities that produce K019, 11 facilities that produce K020, and 8 facilities that produce K030. Table 2-1 lists the number of facilities for each waste code by state. Table 2-2 lists the number of facilities for each waste code in each EPA region.


The production of chlorinated organic chemicals typically consists of the reaction of hydrocarbon or chlorocarbon feedstocks with chlorine or

Table 2-1

FACILITIES PRODUCING K016, K018, K019, K020, AND K030 WASTES BY STATE

| State (EPA Region) | Number of Facilities | | | | | |
|---|---|---|---|---|---|---|
| | K016 | K018 | K019 | K020 | K030 | Total |
| Alabama (IV) | 1 | 0 | 0 | 0 | 0 | 1 |
| California (IX) | 1 | 0 | 0 | 0 | 1 | 2 |
| Kansas (VII) | 1 | 0 | 0 | 0 | 1 | 2 |
| Kentucky (IV) | 0 | 0 | 1 | 1 | 0 | 2 |
| Louisiana (VI) | 2 | 1 | 9 | 6 | 4 | 22 |
| New Jersey (II) | 0 | 1 | 0 | 0 | 0 | 1 |
| Texas (VI) | 0 | 2 | 6 | 4 | 2 | 14 |
| Virginia (III) | 0 | 1 | 0 | 0 | 0 | 1 |
| West Virginia (III) | 2 | 0 | 0 | 0 | 0 | 2 |
| Total: | 7 | 5 | 16 | 11 | 8 | 47 |

Source: Reference 1

Table 2-2

FACILITIES PRODUCING K016, K018, K019, K020, AND K030 WASTES BY EPA REGION

| EPA Region | Number of Facilities | | | | | |
| | K016 | K018 | K019 | K020 | K030 | Total |
|---|---|---|---|---|---|---|
| I | 0 | 0 | 0 | 0 | 0 | 0 |
| II | 0 | 1 | 0 | 0 | 0 | 1 |
| III | 2 | 1 | 0 | 0 | 0 | 3 |
| IV | 1 | 0 | 1 | 1 | 0 | 3 |
| V | 0 | 0 | 0 | 0 | 0 | 0 |
| VI | 2 | 3 | 15 | 10 | 6 | 36 |
| VII | 1 | 0 | 0 | 0 | 1 | 2 |
| VIII | 0 | 0 | 0 | 0 | 0 | 0 |
| IX | 1 | 0 | 0 | 0 | 1 | 2 |
| X | 0 | 0 | 0 | 0 | 0 | 0 |
| Total: | 7 | 5 | 16 | 11 | 8 | 47 |

Source: Reference 1

hydrogen chloride to form the desired product and other by-products. A generic diagram of the production of chlorinated organic chemicals is presented in Figure 2-1. The reaction steps are followed by a series of washing, neutralization, and purification steps to recover the product(s) at the desired quality. Wastes generated in the processes often include spent catalysts, spent wash solutions, light distillation ends, and heavy ends. The characteristics of the specific wastes generated at a facility depend on feedstocks, catalysts, reactor operating conditions, and product purification methods.

Most chlorinated organic chemical products can be produced by a variety of processes. The process used at a particular facility depends upon the size and age of the facility, other products produced at the facility, and the market for chlorinated organic chemicals. Many chlorinated organic chemicals processes are also designed to produce more than one product stream. Product ratios are adjusted to meet market demand by adjusting feedstocks, reactor operating conditions, and product recycle ratios.

2.1.1    K016 Process Description

Heavy ends or distillation residues (commonly referred to as bottoms) from the production of carbon tetrachloride (K016) are generated in the final purification step in carbon tetrachloride production. There are three major commercial processes currently used to produce carbon tetrachloride; K016 is generated by each of these processes.
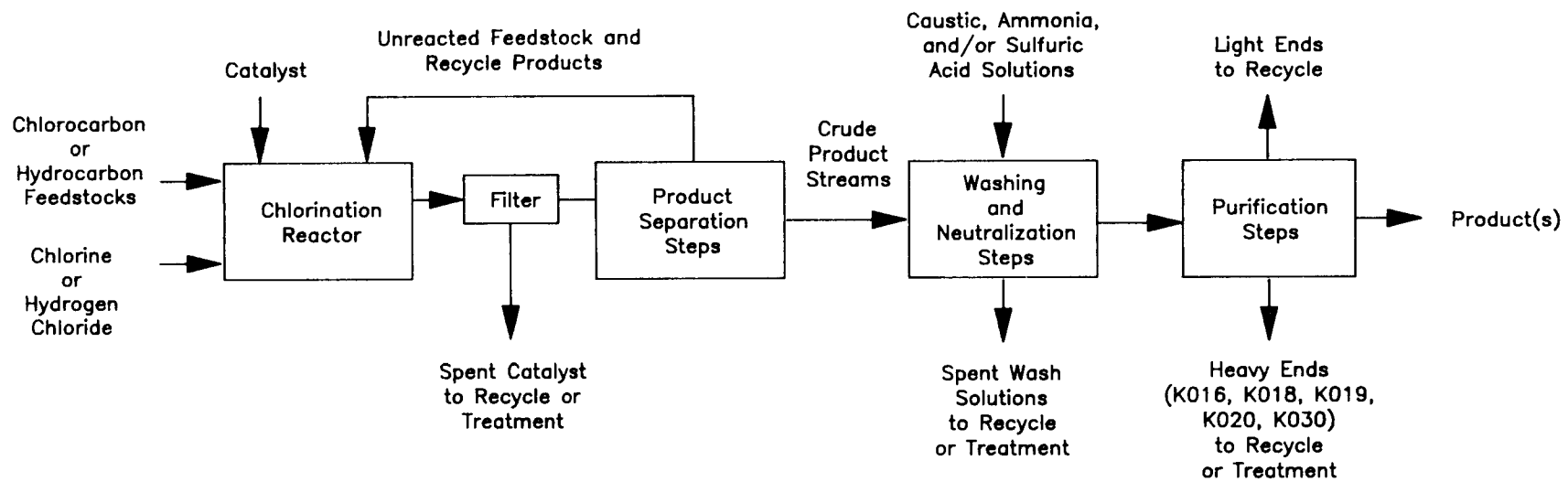
Figure 2—1

GENERIC PROCESS DIAGRAM FOR PRODUCTION
OF CHLORINATED ORGANIC CHEMICALS

1.  Chlorinolysis of hydrocarbon or chlorocarbon feedstocks;
2.  Chlorination of methane; and
3.  Chlorination of carbon disulfide.

In the United States, the majority of carbon tetrachloride is produced via the chlorinolysis process. These processes are discussed in greater detail below.

## Chlorinolysis of Hydrocarbon or Chlorocarbon Feedstocks (K016)

The chlorinolysis process consists of the chlorination of hydrocarbons or chlorocarbons at or near pyrolytic conditions. Feedstocks for the chlorinolysis process can be any of several hydrocarbons or a mixture of hydrocarbons including aliphatics (e.g., propane, propene, or butane), chlorinated aliphatics (e.g., hexachloroethane), and chlorinated aromatic hydrocarbons (e.g., chlorobenzene). If propane is selected as the hydrocarbon feedstock, the chemical equation representing its chlorinolysis to carbon tetrachloride and perchloroethylene (tetrachloroethylene) is:

$$C_3H_8 \quad + \quad 8Cl_2 \quad ----> \quad C_2Cl_4 \quad + \quad CCl_4 \quad + \quad 8HCl$$

propane    chlorine    perchloroethylene    carbon tetrachloride    hydrogen chloride
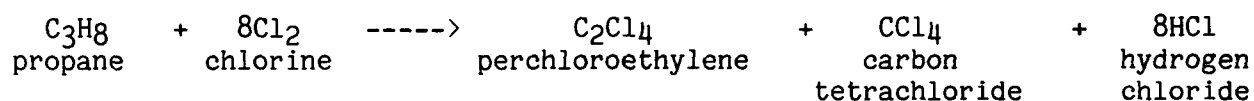
The product distribution and the composition of K016 generated are dependent on the feedstock used. The final product distribution can range from greater than 90 percent carbon tetrachloride (using propane as the feedstock) to greater than 90 percent perchloroethylene (using propene as the feedstock).

In the chlorinolysis process, feedstock and chlorine are vaporized in the feedstock vaporizer and are then sent to the chlorinolysis reactor. The products of the chlorinolysis reaction are separated and purified by a series of distillation steps resulting in final products. The bottoms streams from several of the distillation columns (purification and separation steps) are recycled to the feedstock vaporizer to help control the final product distribution. A bottoms stream is continuously purged from the feedstock vaporizer and is fed to another distillation column. The overheads stream from this column is recycled to the vaporizer and the bottoms stream comprises the waste of concern (K016).

## Chlorination of Methane (K016)

Carbon tetrachloride is produced from methane by a series of chlorination reactions. The chemical reactions that occur are as follows:

$$CH_4 + Cl_2 \longrightarrow CH_3Cl + HCl$$
methane     chlorine          methyl chloride     hydrogen chloride

$$CH_3Cl + Cl_2 \longrightarrow CH_2Cl_2 + HCl$$
methyl chloride   chlorine     methylene chloride   hydrogen chloride

$$CH_2Cl_2 + Cl_2 \longrightarrow CHCl_3 + HCl$$
methylene chloride   chlorine     chloroform     hydrogen chloride

$$CHCl_3 + Cl_2 \longrightarrow CCl_4 + HCl$$
chloroform   chlorine    carbon tetrachloride   hydrogen chloride
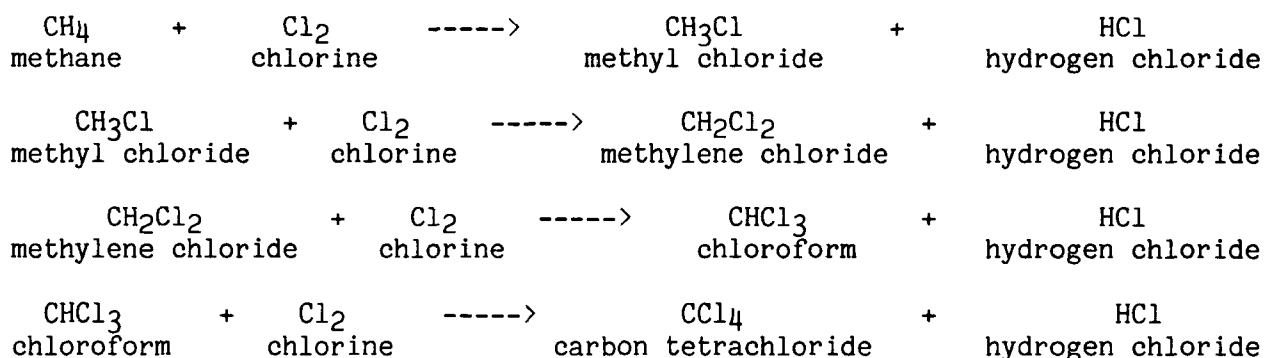
Methane feed, recycled reaction intermediates (methyl chloride, methylene chloride, and chloroform), and chlorine are fed to the primary chlorination reactor in the gas phase. The reactor effluent contains

unreacted methane and chlorine, and a mixture of chlorinated methane products. The distribution of products is dependent upon the ratio of chlorine to methane to recycled chloromethanes in the feed to the reactor.

Methyl chloride and methylene chloride are recovered from the product stream from the primary chlorination reactor by distillation. The bottoms stream from the methyl chloride and methylene chloride recovery column(s) is then fed to a secondary reactor. The secondary chlorination reaction occurs in the liquid phase in the presence of a catalyst. Chloroform is recovered from the product stream and purified by a series of distillation steps.

The bottoms stream from the chloroform recovery column is further chlorinated in a final reactor to form carbon tetrachloride. Carbon tetrachloride is recovered from the reactor effluent by distillation. The bottoms stream from this distillation column comprises the listed waste K016.

Chlorination of Carbon Disulfide (K016)

The overall chemistry for the production of carbon tetrachloride by the chlorination of carbon disulfide is as follows:

$$CS_2 + 3Cl_2 \longrightarrow CCl_4 + S_2Cl_2$$
carbon disulfide    chlorine       carbon tetrachloride    sulfur dichloride

$$CS_2 + 2S_2Cl_2 \longrightarrow 6S + CCl_4$$
carbon disulfide    sulfur dichloride       sulfur    carbon tetrachloride
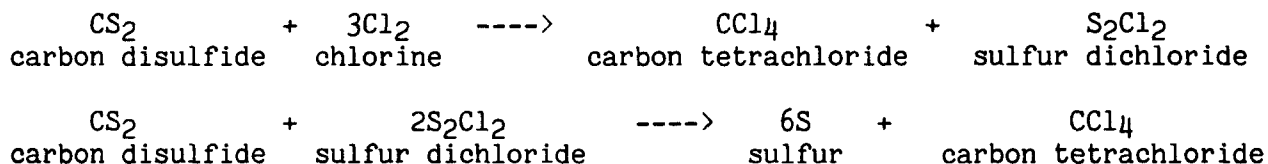
Carbon disulfide, sulfur monochloride, and a recycled stream of these reactants and carbon tetrachloride are mixed and fed to the chlorinator where they react with chlorine in the presence of a catalyst. The product stream is fed to a series of stripping and distillation columns for carbon tetrachloride recovery and purification. The distillation bottoms stream from the final carbon tetrachloride purification column comprises the listed waste K016.

## 2.1.2    K018 Process Description

Heavy ends or distillation residues (bottoms) from the production of ethyl chloride (K018) are generated in the final purification step in ethyl chloride production. In the United States, ethyl chloride is produced via the hydrochlorination of ethylene. In the process, ethylene and anhydrous hydrogen chloride gases are mixed and reacted in the presence of an aluminum chloride catalyst to form ethyl chloride. The chemical reaction that occurs is as follows:

$$C_2H_4 \ + \ HCl \ \xrightarrow{\quad AlCl_3 \quad} \ C_2H_5Cl$$

| $C_2H_4$ | + | HCl | $\xrightarrow{AlCl_3}$ | $C_2H_5Cl$ |
|---|---|---|---|---|
| ethylene | | hydrogen chloride | | ethyl chloride |
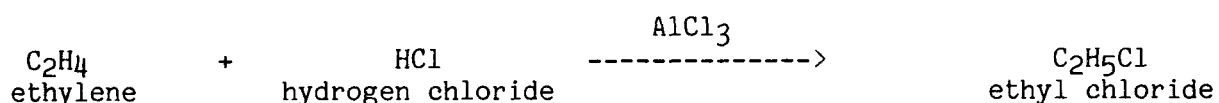
By-products of the reaction include a hydropolymer oil and other chlorinated hydrocarbons. The crude ethyl chloride is separated from heavier polymers and refined by fractionation. The bottoms stream from this fractionation column comprises the waste of concern (K018).

## 2.1.3    K019 Process Description

Heavy ends (bottoms) from the distillation of ethylene dichloride (K019) are generated in the final purification step in ethylene dichloride production. In the United States, ethylene dichloride may be produced by the direct chlorination of ethylene or by the oxychlorination of ethylene; however, the vast majority of ethylene dichloride is currently produced using a combination of these two processes. The overall chemical reactions that occur are as follows:

Direct chlorination of ethylene:

$$Cl_2 \; + \; C_2H_4 \; \text{-----------}> \; C_2H_4Cl_2$$
chlorine    ethylene                    ethylene dichloride

Oxychlorination of ethylene:
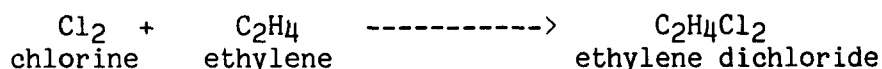
$$2C_2H_4 \; + \; O_2 \; + \; 4HCl \; \text{-----}> \; 2C_2H_4Cl_2 \; + \; 2H_2O$$
ethylene       oxygen    hydrogen           ethylene      water
                        chloride           dichloride
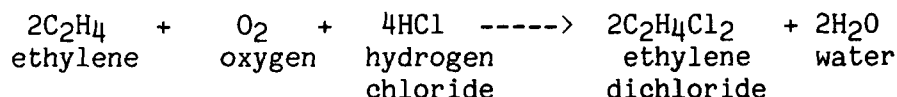
In the first process, ethylene and chlorine are reacted to produce ethylene dichloride by direct chlorination. In the second process, ethylene is reacted with hydrogen chloride to produce ethylene dichloride by oxychlorination. The crude ethylene dichloride from both processes is then combined and purified using distillation. Heavy ends from the ethylene dichloride purification column comprise the waste of concern (K019).

## 2.1.4    KO20 Process Description

Heavy ends (bottoms) from the distillation of vinyl chloride (KO20) are generated in the final purification step in vinyl chloride monomer production. In the United States, there are three processes currently used to produce the vast majority of vinyl chloride monomer; the listed waste KO20 is generated by each of these processes.

1. Thermal cracking of ethylene dichloride;

2. Direct chlorination and oxychlorination of ethylene followed by the thermal cracking of ethylene dichloride; and

3. Hydrochlorination of acetylene.

These processes are discussed in greater detail below.

### Thermal Cracking of Ethylene Dichloride (KO20)

Vinyl chloride monomer is produced by passing ethylene dichloride (EDC) through a cracking furnace. The chemistry of the reaction is as follows:
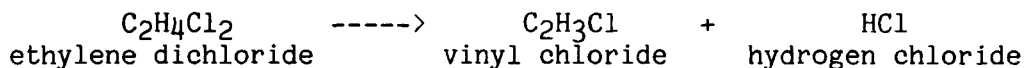
$$C_2H_4Cl_2 \quad ----> \quad C_2H_3Cl \quad + \quad HCl$$
$$\text{ethylene dichloride} \qquad \text{vinyl chloride} \quad \text{hydrogen chloride}$$

The vinyl chloride monomer product is purified through a series of distillation steps. In the final distillation column, the vinyl chloride monomer product is recovered as the overhead stream. The bottoms stream, consisting of unconverted EDC and higher-boiling hydrocarbons, is the waste

of concern (K020). In some processes, this bottoms stream is further

distilled to recover ethylene dichloride for recycle to the cracking furnace.

In these processes, the heavy ends stream from the ethylene dichloride

recovery column is the waste of concern (K020).


### Direct Chlorination and Oxychlorination of Ethylene Followed by the Thermal Cracking of Ethylene Dichloride (K020)

This process uses two sub-processes to produce ethylene dichloride

(EDC), which is subsequently cracked in a furnace to form the vinyl chloride

monomer (VCM). The chemical reactions that occur are as follows:

Direct chlorination of ethylene:

$$Cl_2 \ + \ C_2H_4 \ \text{-----} \text{>} \ C_2H_4Cl_2$$
chlorine  ethylene        ethylene dichloride

Oxychlorination of ethylene:

$$2C_2H_4 \ + \ O_2 \ + \ 4HCl \ \text{-----} \text{>} \ 2C_2H_4Cl_2 \ + \ 2H_2O$$
ethylene   oxygen   hydrogen         ethylene    water
                    chloride         dichloride

Thermal Cracking of ethylene dichloride:
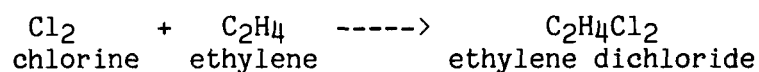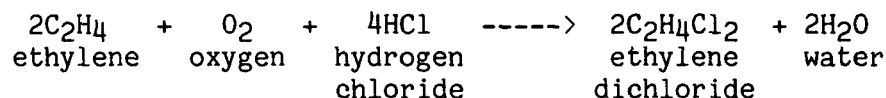
$$C_2H_4Cl_2 \ \text{-----} \text{>} \ C_2H_3Cl \ + \ HCl$$
ethylene dichloride      vinyl chloride   hydrogen chloride
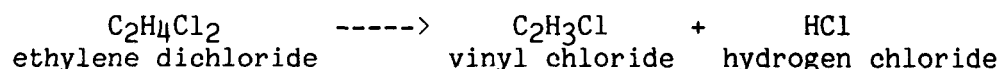
In the first sub-process, ethylene and chlorine are reacted to

produce EDC by direct chlorination. In the second sub-process ethylene is

reacted with hydrogen chloride (produced from the subsequent thermal cracking

operation) to produce EDC by oxychlorination. The crude EDC from both sources

can be washed and purified in the same process route and then fed to the EDC

cracking furnace.

The vinyl chloride monomer product is purified through a series of distillation steps. In the final purification column, the vinyl chloride monomer product is recovered as the overheads stream. The listed waste K020, consisting of unconverted EDC and higher-boiling hydrocarbons, comprise the bottoms stream. In some processes, this bottoms stream is further distilled to remove EDC for recycle to the cracking furnace. The heavy ends stream from the EDC recovery column is the waste of concern (K020).

## Hydrochlorination of Acetylene (K020)

The hydrochlorination of acetylene is a vapor phase reaction between acetylene and hydrogen chloride in the presence of a catalyst. The chemical reaction that occurs is as follows:

$$C_2H_2 + HCl \xrightarrow{\text{catalyst}} C_2H_3Cl$$

acetylene     hydrogen chloride           vinyl chloride
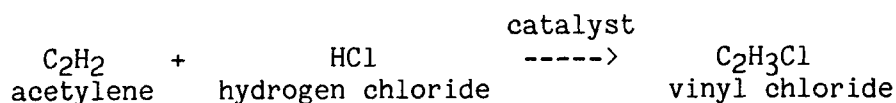
Hydrogen chloride and acetylene gas react in a tubular reactor in the presence of a catalyst. The reactor effluent gases consist of vinyl chloride monomer, ethylidene chloride, acetaldehyde, and unreacted acetylene and hydrogen chloride. These gases are quenched, and the unreacted acetylene and hydrogen chloride are recycled to the reactor. The bottoms from the quench column, containing crude vinyl chloride monomer, are washed with caustic and water and purified by distillation. The vinyl chloride monomer product is recovered as the overhead stream from the final purification column, and the bottoms stream is the listed waste K020.

## 2.1.5    KO30 Process Description

Heavy ends or distillation residues (bottoms) from the production of trichloroethylene and perchloroethylene (KO30) are generated in the final purification steps in production of these products. In the United States, there are three processes currently used to produce the vast majority of trichloroethylene and perchloroethylene (tetrachloroethylene); the listed waste KO30 is generated by each of these processes.

1. Oxychlorination of ethylene dichloride;
2. Direct chlorination of ethylene dichloride and other chlorinated hydrocarbons; and
3. Chlorination of acetylene.

These processes are discussed in greater detail below.

### Oxychlorination of Ethylene Dichloride (KO30)

Trichloroethylene and perchloroethylene are produced when ethylene dichloride is reacted with oxygen and chlorine in an oxychlorinator. The overall chemical reaction that occurs is as follows:

$$8C_2H_4Cl_2 \; + \; 6Cl_2 \; + \; 7O_2 \; \longrightarrow \; 4C_2HCl_3 \; + \; 4C_2Cl_4 \; + \; 14H_2O$$

ethylene    chlorine    oxygen    trichloro-    tetrachloro-    water
dichloride                             ethylene    ethylene
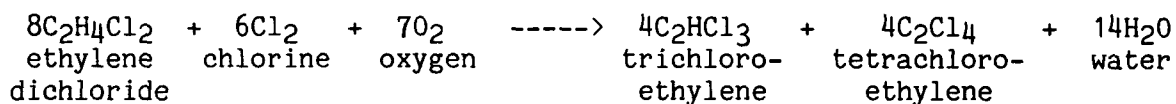
The feed proportions can be adjusted to vary the product ratio from nearly all tetrachloroethylene to nearly all trichloroethylene.

The oxychlorinator is typically a fluidized bed reactor where an oxychlorination catalyst, such as copper chloride, is used. The reactor effluent is processed through a condenser and a decanter.

The organic layer from the decanter is dried in an azeotropic distillation column. The resulting chlorohydrocarbon products are then separated in the trichloroethylene/perchloroethylene (TCE/PCE) distillation column. The TCE is removed as the overhead stream and the PCE is removed as the bottoms stream.

The crude TCE is refined by distillation and is removed as the bottoms stream. (The overheads stream is recycled to the oxychlorinator). The crude PCE is also refined by distillation and is removed as the overheads stream. The bottoms stream from the perchloroethylene distillation column is the listed waste K030.

### Direct Chlorination of Ethylene Dichloride and Other Chlorinated Hydrocarbons (K030)

Trichloroethylene and perchloroethylene are produced, in addition to hydrogen chloride, trichloroethane, and carbon tetrachloride, when ethylene dichloride and other high-boiling chlorohydrocarbons are reacted with chlorine. The chemical reactions that occur are as follows:

$$C_2H_4Cl_2 \; + \; 2Cl_2 \; \xrightarrow{\hspace{1cm}} \; C_2HCl_3 \; + \; 3HCl$$

| $C_2H_4Cl_2$ | $2Cl_2$ | $C_2HCl_3$ | $3HCl$ |
|---|---|---|---|
| ethylene dichloride | chlorine | trichloro-ethylene | hydrogen chloride |

$$C_2H_4Cl_2 \; + \; 3Cl_2 \; \xrightarrow{\hspace{1cm}} \; C_2Cl_4 \; + \; 4HCl$$

| $C_2H_4Cl_2$ | $3Cl_2$ | $C_2Cl_4$ | $4HCl$ |
|---|---|---|---|
| ethylene dichloride | chlorine | tetrachloro-ethylene | hydrogen chloride |

$$ClCH_2CHCl_2 \quad + \quad Cl_2 \quad \text{-----} > \quad C_2HCl_3 \quad + \quad 2HCl$$

1,1,2-trichloro-    chlorine            trichloro-    hydrogen
   ethane                              ethylene    chloride

$$C_2H_4Cl_2 \quad + \quad 5Cl_2 \quad \text{-----} > \quad 2CCl_4 \quad + \quad 4HCl$$

ethylene     chlorine              carbon       hydrogen
dichloride                     tetrachloride   chloride

The reaction products are quenched and refined by distillation. Unreacted ethylene dichloride is also recovered and recycled to the reactor. In the final distillation column, the perchloroethylene product is recovered as the overheads stream. The bottoms stream from the perchloroethylene recovery column is the waste of concern (K030).

### Chlorination of Acetylene (K030)

Trichloroethylene and perchloroethylene are produced when acetylene is reacted with chlorine. The chemical reactions that occur are as follows:

Direct chlorination of acetylene:

$$C_2H_2 \quad + \quad 2Cl_2 \quad \xrightarrow{\text{catalyst}} \quad C_2H_2Cl_4$$

acetylene    chlorine                  tetrachloroethane
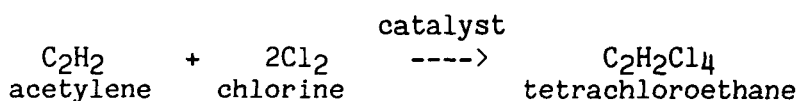
Thermal cracking of tetrachloroethane intermediate:

$$C_2H_2Cl_4 \quad \text{----} > \quad C_2HCl_3 \quad + \quad HCl$$

tetrachloroethane          trichloroethylene   hydrogen chloride

Direct chlorination of tetrachoroethane intermediate:

$$C_2H_2Cl_4 \quad + \quad Cl_2 \quad \text{----} > \quad C_2Cl_4 \quad + \quad 2HCl$$

tetrachloroethane   chlorine        perchloroethylene  hydrogen chloride

Acetylene, chlorine, and a catalyst are fed to the chlorinator which contains a large mass of liquid tetrachloroethane boiling under reduced pressure. The reactor effluent, the tetrachloroethane intermediate, is condensed and may be split into the following three streams:

(1) Recycle to the acetylene chlorinator,

(2) Feed to the pyrolysis reactor for thermal cracking to trichloroethylene, and/or

(3) Feed to the tetrachloroethane chlorinator for production of perchloroethylene.

In the thermal cracking to trichloroethylene, condensed tetrachloroethane, a trichloroethylene recycle stream, and a catalyst are fed to the thermal cracking reactor. The effluent from this reactor is distilled to recover trichloroethylene product as the overheads stream. The bottoms stream from the trichloroethylene recovery column is the waste of concern (K030). A portion of the waste stream may be purged to remove tars and the remainder recycled to the pyrolysis reactor.

In the direct chlorination of tetrachloroethane, condensed tetra-chloroethane is reacted with chlorine to produce perchloroethylene. The reactor effluent is distilled to recover perchloroethylene product as the overheads stream. The bottoms stream from the perchloroethylene recovery column is the waste of concern (K030). A portion of the waste stream may be purged to remove tars and the remainder recycled to the thermal cracking reactor.

## 2.2    Waste Characterization

This section presents all waste characterization data available to the Agency for K016, K018, K019, K020, and K030. The approximate concentrations of major constituents comprising these wastes are included in Table 2-3. The percent concentrations in the wastes were estimated using engineering judgment based on chemical analyses (analytical data upon which the estimates were based are reported in references 9, 10, and 11). Calculations supporting these estimates are presented in Appendix B.

Tables 2-4 through 2-8 present, by waste code, the ranges of BDAT constituents and other parameters identified for the waste. These data were obtained from a variety of sources as referenced on the tables including literature and sampling and analysis episodes. These wastes contain chlorinated aliphatic and aromatic compounds such as chlorinated ethanes, methanes, benzenes, and butadienes. Additionally, these wastes typically contain low concentrations of metals and may contain high levels of filterable solids.

## 2.3    Determination of Waste Treatability Group

Fundamental to waste treatment is the concept that the type of treatment technology used and the level of treatment achievable depend on the physical and chemical characteristics of the waste. In cases where EPA believes that constituents present in wastes represented by different codes

can be treated to similar concentrations by using the same technologies, the Agency combines the codes into one separate treatability group.

Based on a careful review of the generation of K016, K018, K019, K020, and K030 and all available data characterizing these wastes, the Agency has determined that these wastes represent a single waste treatability group. K016, K018, K019, K020, and K030 are all still bottoms generated by similar processes: the chlorination or oxychlorination of hydrocarbon feedstocks often at high temperatures and pressures. Wastes generated as column bottoms from the purification of chlorinated organic product streams are typically comprised of chlorinated aliphatic and aromatic compounds such as chlorinated ethanes, methanes, benzenes, and butadienes. These wastes typically contain low concentrations of metals. Although the concentrations of specific con-stituents will vary from facility to facility, all of the wastes contain similar levels of BDAT organics and metals and are expected to be treatable to the same levels using the same technology. As a result, EPA has examined the sources and characteristics of the wastes, applicable and demonstrated treatment technologies, and attainable treatment performance in order to support a single regulatory approach for these five chlorinated organic chemicals wastes.

Table 2-3

MAJOR CONSTITUENTS IN K016, K018, K019, K020, AND K030 WASTES

| Constituent | Concentration (%) | | | | |
|---|---|---|---|---|---|
| | K016 | K018 | K019 | K020 | K030 |
| BDAT List Constituents: | | | | | |
| Chloroethane | * | * | - | * | * |
| 1,1-Dichloroethane | * | * | - | * | * |
| 1,2-Dichloroethane | * | * | 10 | * | * |
| Hexachlorobenzene | * | * | - | * | * |
| Hexachlorobutadiene | * | * | - | * | * |
| Hexachloroethane | * | * | - | * | * |
| Pentachloroethane | * | * | - | * | * |
| 1,1,2,2-Tetrachloroethane | * | * | - | * | * |
| Tetrachloroethene | * | * | - | * | * |
| 1,1,2-Trichloroethane | * | * | 4 | * | * |
| Other BDAT List constituents | * | * | 2 | * | * |
| Other constituents | * | * | 82 | * | * |
| Water | * | * | 2 | * | * |
| | | | | | |
| TOTAL | 100 | 100 | 100 | 100 | 100 |

-This constituent has not been detected in the waste or represents less than 1% of the total composition.

Sources: Environ Report (Reference 9), Onsite Engineering Report for Rollins (Reference 10), Analytical Data Reports (Reference 11).

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-4

AVAILABLE CHARACTERIZATION DATA FOR K016

| Source of Data: | Untreated Waste Concentration, ppm | | |
|---|---|---|---|
| | (a) | (b) | Range |
| BDAT List Organics | | | |
| Volatiles | | | |
| 42. Tetrachloroethene | * | * | * |
| Semivolatiles | | | |
| 110. Hexachlorobenzene | * | * | * |
| 111. Hexachlorobutadiene | * | * | * |
| 112. Hexachlorocyclopentadiene | * | * | * |
| 113. Hexachloroethane | * | * | * |
| Other Parameters | (c) | | |
| pH (standard units) | 5.7 | | |

(a) Analytical Data Report (Reference 11).
(b) Analytical Data Report (Reference 11).
(c) Environ Report, Reference 9.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-5

AVAILABLE CHARACTERIZATION DATA FOR K018

| | Untreated Waste Concentration, ppm | | |
|---|---|---|---|
| Source of Data: | (a) | (b) | Range |

BDAT List Organics

Volatiles

| | | | |
|---|---|---|---|
| 12. Chloroethane | * | * | * |
| 15. Chloromethane | * | * | * |
| 22. 1,1-Dichloroethane | * | * | * |
| 23. 1,2-Dichloroethane | * | * | * |
| 45. 1,1,1-Trichloroethane | * | * | * |
| 46. 1,1,2-Trichloroethane | * | * | * |

Semivolatiles

| | | | |
|---|---|---|---|
| 110. Hexachlorobenzene | * | * | * |
| 111. Hexachlorobutadiene | * | * | * |
| 113. Hexachloroethane | * | * | * |
| 137. Pentachloroethane | * | * | * |

Other Parameters

No data are available.

(a) Analytical Data Report (Reference 11).
(b) Analytical Data Report (Reference 11).
(c) This constituent was also detected in the blank; Results of the blank analysis were not contained in the ADR. The contaminant concentration in the blank is believed to be insignificant in comparison to the constituent concentration in the corresponding sample.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-6

AVAILABLE CHARACTERIZATION DATA FOR K019

| Source of Data: | Untreated Waste Concentration, ppm | | | |
|---|---|---|---|---|
| | (a) | (b) | (d) | Range |
| BDAT List Organics | | | | |
| Volatiles | | | | |
| 7. Carbon tetrachloride | 3,500-4,100 | * | * | * |
| 9. Chlorobenzene | <2,000-3,000 | * | * | * |
| 14. Chloroform | 4,600-6,000 | * | * | * |
| 22. 1,1-Dichloroethane | <2,000-2,200 | * | * | * |
| 23. 1,2-Dichloroethane | 87,000-130,000 | * | * | * |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | * | * | * |
| 42. Tetrachloroethene | 6,000-7,800 | * | * | * |
| 45. 1,1,1-Trichloroethane | 33,000-81,000 | * | * | * |
| 46. 1,1,2-Trichloroethane | <2,000 | * | * | * |
| 47. Trichloroethene | 2,200-3,210 | * | * | * |
| Semivolatiles | | | | |
| 68. Bis(2-chloroethyl) ether | 280-340 | * | * | * |

(a) Onsite Engineering Report from Rollins Environmental Services, Deer Park, TX, Table 6-3, Reference 10
(b) Analytical Data Report (Reference 11).
(c) This constituent was also detected in the blank; results of the blank analysis were not contained in the ADR. The contaminant concentration in the blank is believed to be insignificant in comparison to the constituent concentration in the corresponding sample.
(d) Analytical Data Report (Reference 11).
NA - Not Analyzed

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-6 (Continued)

AVAILABLE CHARACTERIZATION DATA FOR K019

| Source of Data: | Untreated Waste Concentration, ppm | | | |
| | (a) | (b) | (d) | Range |
| --- | --- | --- | --- | --- |
| BDAT List Organics (Continued) | | | | |
| Semivolatiles (Continued) | | | | |
| 88. p-Dichlorobenzene | 74-90 | * | * | * |
| 109. Fluorene | 16-22 | * | * | * |
| 110. Hexachlorobenzene | 60-87 | * | * | * |
| 111. Hexachlorobutadiene | <50 | * | * | * |
| 113. Hexachloroethane | 85-120 | * | * | * |
| 121. Naphthalene | 314-470 | * | * | * |
| 136. Pentachlorobenzene | 51-65 | * | * | * |
| 141. Phenanthrene | 11-21 | * | * | * |
| 148. 1,2,4,5-Tetrachlorobenzene | 62-86 | * | * | * |
| 150. 1,2,4-Trichlorobenzene | 65-100 | * | * | * |
| BDAT List Metals | | | | |
| 155. Arsenic | <0.2-1.2 | * | * | * |
| 156. Barium | <0.9-0.97 | * | * | * |
| 158. Cadmium | <0.3 - 0.63 | * | * | * |

(a) Onsite Engineering Report from Rollins Environmental Services, Deer Park, TX, Table 6-3, Reference 10
(b) Analytical Data Report (Reference 11).
(c) This constituent was also detected in the blank; results of the blank analysis were not contained in the ADR. The contaminant concentration in the blank is believed to be insignificant in comparison to the constituent concentration in the corresponding sample.
(d) Analytical Data Report (Reference 11).
NA - Not Analyzed

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-6 (Continued)

AVAILABLE CHARACTERIZATION DATA FOR K019

| Source of Data: | Untreated Waste Concentration, ppm | | | |
|---|---|---|---|---|
| | (a) | (b) | (d) | Range |
| BDAT List Inorganics | | | | |
| 159. Chromium | 1.8-5.3 | * | * | * |
| 160. Copper | <1.0-3.6 | * | * | * |
| 161. Lead | 2.3-3.5 | * | * | * |
| 163. Nickel | 2.2-6.0 | * | * | * |
| 168. Zinc | 4.4-9.4 | * | * | * |
| 171. Sulfide | 790 | * | * | * |
| | | | | |
| Other Parameters | (a) | (c) | | |
| BTU content (BTU/lb) | 4,012-4,944 | 2,500-4,500 | | 2,500-4,944 |
| Filterable solids (%) | 60.4-83.3 | 0-1 | | 0-83.3 |
| pH (Standard units) | NA | 3 | | 3 |
| TOC (%) | NA | 14-25 | | 14-25 |
| TOX (%) | NA | 70-85 | | 70-85 |
| Viscosity (mPa-s) | NA | 0.49-2 | | 0.49-2 |

(a) Onsite Engineering Report from Rollins Environmental Services, Deer Park, TX, Table 6-3, Reference 10
(b) Analytical Data Report (Reference 11).
(c) Environ Report, Reference 9
(d) Analytical Data Report (Reference 11).
NA - Not Analyzed

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-7

AVAILABLE CHARACTERIZATION DATA FOR K020

| Source of Data: | Untreated Waste Concentration, ppm | |
| | (a) | Range |
| --- | --- | --- |
| BDAT List Organics | | |
| Volatiles | | |
| 23. 1,2 - Dichloroethane | * | * |
| 41. 1,1,2,2 - Tetrachloroethane | * | * |
| 42. Tetrachloroethene | * | * |
| 46. 1,1,2-Trichloroethane | * | * |
| Other Parameters | (b) | |
| Filterable solids (%) | 0.5 | |
| pH (standard units) | 3 | |
| TOC (%) | 38 | |
| TOX (%) | 57 | |
| Viscosity (mPa-s) | 0.85 | |

(a) Analytical Data Report (Reference 11).
(b) Environ Report, Reference 9
(c) This constituent was also detected in the blank; results of the blank
    analysis were not contained in the ADR. The contaminant concentration
    in the blank is believed to be insignificant in comparison to the constituent
    concentration in the corresponding sample.

*This information has been claimed as RCRA Confidential Business Information.
The information is available in the confidential portion of the
Administrative Record for this rulemaking.

Table 2-8

AVAILABLE CHARACTERIZATION DATA FOR K030

| Source of Data: | Untreated Waste Concentration, ppm (a) | Range |
|---|---|---|
| **BDAT List Organics** | | |
| **Volatiles** | | |
| 42. Tetrachloroethene | * | * |
| **Semivolatiles** | | |
| 87. o-Dichlorobenzene | * | * |
| 88. p-Dichlorobenzene | * | * |
| 111. Hexachlorobutadiene | * | * |
| 112. Hexachlorocyclopentadiene | * | * |
| 113. Hexachloroethane | * | * |
| 115. Hexachloropropene | * | * |
| 136. Pentachlorobenzene | * | * |
| 137. Pentachloroethane | * | * |
| 148. 1,2,4,5 - Tetrachlorobenzene | * | * |
| 150. 1,2,4 - Trichlorobenzene | * | * |
| **Other Parameters** | | |

No data are available.

(a) Analytical Data Report (Reference 11).

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

3.0     APPLICABLE/DEMONSTRATED TREATMENT TECHNOLOGIES

In the previous section of this document, the five chlorinated organic wastes (K016, K018, K019, K020, and K030) were characterized and a single waste treatability group was established for these wastes. In this section, treatment technologies applicable for treatment of wastes in this waste group are identified. Detailed descriptions of the technologies that are demonstrated on these wastes or on wastes judged to be similar are presented in this section along with available performance data.

3.1     Applicable Treatment Technologies

The Agency has identified the following treatment technologies as applicable for K016, K018, K019, K020, and K030: incineration (fluidized bed, rotary kiln, and liquid injection), solvent extraction followed by incineration of the contaminated solvents, and total recycle or reuse. Since K016, K018, K019, K020, and K030 contain high concentrations of organic compounds as shown in Section 2.0, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste (i.e., incineration, solvent extraction, and total recycle or reuse). The treatment technologies applicable for treating organics in K016, K018, K019, K020, and K030 were identified based on current literature sources, field testing, and current waste treatment practices.

The Agency recognizes that wastewater forms of K016, K018, K019, K020, and K030, as defined in Section 1.0, may also be generated from the treatment of K016, K018, K019, K020, and K030. For example, the incineration of K016, K018, K019, K020, and K030 generates combustion gas scrubber water that would be designated as a wastewater form of K016, K018, K019, K020, and K030 derived from the treatment of these listed wastes. The scrubber water would be expected to contain low levels of metal and organic constituents since the untreated wastes contain low concentrations of metals and the majority of organics would be destroyed in the incinerator. Some wastewaters that are generated by the treatment of K016, K018, K019, K020, and K030 by other technologies may contain organic constituents at treatable concentrations. The Agency has identified the following treatment technologies as potentially applicable for treatment of wastewater forms of K016, K018, K019, K020, and K030: biological treatment, carbon adsorption, and solvent extraction. Since wastewater forms of K016, K018, K019, K020, and K030 may contain organic hazardous constituents at treatable levels, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste (i.e., biological treatment, carbon adsorption, and solvent extraction).

## 3.2 Demonstrated Treatment Technologies

The demonstrated technologies that the Agency has identified for treatment of K016, K018, K019, K020, and K030 are total recycle or reuse and incineration, including rotary kiln incineration and liquid injection

incineration. Each of the demonstrated technologies are discussed below. The Agency is not aware of any facilities that treat wastewater forms of KO16, KO18, KO19, KO20, or KO30.

A. Total Recycle or Reuse. EPA is aware of three plants that recycle or reuse KO16, KO19, or KO30 as feedstocks in manufacturing processes. Specific information regarding the recycle or reuse of these wastes has been claimed as confidential business information by the facilities.

B. Incineration. Incineration provides for destruction of the organics in the waste. As described in Section 1.0, the best measure of performance for a destruction technology is the total amount of constituent remaining after treatment. Incineration generally results in the formation of two treatment residuals: ash and scrubber water. A detailed description of incineration treatment technology is presented in Section 3.4. The Agency tested a full-scale rotary kiln incineration process treating KO19 (plant A). Liquid injection incineration has also been demonstrated on a commercial scale for KO16, KO18, KO19, KO20, and KO30.

The treatment process at Plant A which was tested by the Agency consisted of a rotary kiln, afterburner, and a combustion gas scrubbing system. Combustion exhaust gases from the rotary kiln pass through the kiln exit duct to the afterburner chamber. Kiln ash residue is collected in a storage bin. KO19 and another waste were fed to the rotary kiln for treatment by incineration. The KO19 treated during the sampling episode was generated

during the clean out of a purification column in an ethylene dichloride manufacturing process. The ethylene dichloride manufacturing process used by the generator is the combined ethylene chlorination and oxychlorination process described in Section 2.1.3. The other waste incinerated with K019 (referred to by plant personnel as "RCRA Blend") was a mixture of various industrial wastes including water, oil, and solvents recovered from a waste treatment step at a waste disposal company.

Tables 3-1 through 3-6 present, by sample set, the BDAT List constituents detected in the untreated (K019 and RCRA Blend) and treated (rotary kiln ash) wastes from the rotary kiln incineration treatment system. These tables also present design and operating data for each sample set. Testing procedures used to analyze these constituents are specifically identified in the analytical quality assurance/quality control discussion of this background document (Appendix D).

Combustion exhaust gases from the rotary kiln (from rotary kiln treatment of K019 and RCRA Blend waste), and two other wastes ("PCB Blend" waste and mercaptan-contaminated waste) were fed to the afterburner and combustion gas scrubber system for treatment by incineration and wet gas scrubbing. PCB Blend waste is a mixture of RCRA Blend waste and various PCB-containing waste oils including mineral, hydraulic, and transformer oils. Mercaptan-contaminated waste is comprised of site run-off water from plant A and wastewater received by plant A from other sources.

Tables 3-7 through 3-12 present, by sample set, the BDAT List

constituents detected in the untreated (K019, RCRA Blend, PCB Blend, and

mercaptan-contaminated waste) and treated (combustion gas scrubber discharge

water) wastes from the combustion gas scrubber treatment system. These tables

also present design and operating data for each sample set. Testing

procedures used to analyze these constituents are specifically identified in

the analytical quality assurance/quality control discussion of this background

document (Appendix D).


## 3.3     Available Treatment Technologies


As defined in Section 1.0, an available treatment technology is one

that (1) is not a proprietary or patented process that cannot be purchased or

licensed from the proprietor (in other words, is commercially available), and

(2) substantially diminishes the toxicity of the waste or substantially

reduces the likelihood of migration of hazardous constituents from the waste.

The demonstrated technology for treatment of K016, K018, K019, K020, and K030,

incineration (rotary kiln incineration and liquid injection incineration), is

considered to be commercially available.


The wastes in this treatability group as generated or upon heating

are amenable to pumping and can readily be atomized. This has facilitated the

use of liquid injection incineration systems onsite adjacent to the waste

generating units. When these wastes are allowed to cool they become viscous

and therefore, difficult to atomize. It is common practice to containerize

these wastes for offsite transport and disposal. The containerized wastes can be incinerated in a rotary kiln incineration system, as was the case at plant A.

Total recyle or reuse are not considered to be commercially available as they are proprietary or patented and cannot be purchased or licensed.

3.4      Detailed Description of The Demonstrated Treatment Technology: Incineration

3.4.1    Incineration

This section addresses the commonly used incineration technologies: Liquid injection, rotary kiln, fluidized bed incineration, and fixed hearth. A discussion is provided regarding the applicability of these technologies, the underlying principles of operation, a technology description, waste characteristics that affect performance, and finally important design and operating parameters. As appropriate, the subsections are divided by type of incineration unit.

## Applicability and Use of Incineration

### Liquid Injection

Liquid injection is applicable to wastes that have viscosity values sufficiently low so that the waste can be atomized in the combustion chamber. A range of literature maximum viscosity values are reported with the low being 100 SSU and the high being 10,000 SSU. It is important to note that viscosity is temperature dependent so that while liquid injection may not be applicable to a waste at ambient conditions, it may be applicable when the waste is heated. Other factors that affect the use of liquid injection are particle size and the presence of suspended solids. Both of these waste parameters can cause plugging of the burner nozzle.

### Rotary Kiln/Fluidized Bed/Fixed Hearth

These incineration technologies are applicable to a wide range of hazardous wastes. They can be used on wastes that contain high or low total organic content, high or low filterable solids, various viscosity ranges, and a range of other waste parameters. EPA has not found these technologies to be demonstrated on wastes that are comprised essentially of metals with low organic concentrations. In addition, the Agency expects that some of the high metal content wastes may not be compatible with existing and future air emission limits without emission controls far more extensive than currently practiced.

## Underlying Principles of Operation

### Liquid Injection

The basic operating principle of this incineration technology is that incoming liquid wastes are volatilized and then additional heat is supplied to the waste to destabilize the chemical bonds. Once the chemical bonds are broken, these constituents react with oxygen to form carbon dioxide and water vapor. The energy needed to destabilize the bonds is referred to as the energy of activation.

### Rotary Kiln and Fixed Hearth

There are two distinct principles of operation for these incineration technologies, one for each of the chambers involved. In the primary chamber, energy, in the form of heat, is transferred to the waste to achieve volatilization of the various organic waste constituents. During this volatilization process some of the organic constituents will oxidize to $CO_2$ and water vapor. In the secondary chamber, additional heat is supplied to overcome the energy requirements needed to destabilize the chemical bonds and allow the constituents to react with excess oxygen to form carbon dioxide and water vapor. The principle of operation for the secondary chamber is similar to liquid injection.

Fluidized Bed

The principle of operation for this incineration technology is somewhat different than for rotary kiln and fixed hearth incineration relative to the functions of the primary and secondary chambers. In fluidized bed, the purpose of the primary chamber is not only to volatilize the wastes but also to essentially combust the waste. Destruction of the waste organics can be accomplished to a better degree in the primary chamber of this technology than for rotary kiln and fixed hearth because of 1) improved heat transfer from fluidization of the waste using forced air and 2) the fact that the fluidization process provides sufficient oxygen and turbulence to convert the organics to carbon dioxide and water vapor. The secondary chamber (referred to as the freeboard) generally does not have an afterburner; however, additional time is provided for conversion of the organic constituents to carbon dioxide, water vapor, and hydrochloric acid if chlorine is present in the waste.

## Description of Incineration Process

Liquid Injection

The liquid injection system is capable of incinerating a wide range of gases and liquids. The combustion system has a simple design with virtually no moving parts. A burner or nozzle atomizes the liquid waste and injects it into the combustion chamber where it burns in the presence of air or oxygen. A forced draft system supplies the combustion chamber with air to provide oxygen for combustion and turbulence for mixing. The combustion

chamber is usually a cylinder lined with refractory (i.e., heat resistant) brick and can be fired horizontally, vertically upward, or vertically downward. Figure 3-1 illustrates a liquid injection incineration system.

Rotary Kiln

A rotary kiln is a slowly rotating, refractory-lined cylinder that is mounted at a slight incline from the horizontal (see Figure 3-2). Solid wastes enter at the high end of the kiln, and liquid or gaseous wastes enter through atomizing nozzles in the kiln or afterburner section. Rotation of the kiln exposes the solids to the heat, vaporizes them, and allows them to combust by mixing with air. The rotation also causes the ash to move to the lower end of the kiln where it can be removed. Rotary kiln systems usually have a secondary combustion chamber or afterburner following the kiln for further combustion of the volatilized components of solid wastes.

Fluidized Bed

A fluidized bed incinerator consists of a column containing inert particles such as sand which is referred to as the bed. Air, driven by a blower, enters the bottom of the bed to fluidize the sand. Air passage through the bed promotes rapid and uniform mixing of the injected waste material within the fluidized bed. The fluidized bed has an extremely high heat capacity (approximately three times that of flue gas at the same temperature), thereby providing a large heat reservoir. The injected waste reaches ignition temperature quickly and transfers the heat of combustion back to the

WATER

GAS TO AIR
POLLUTION
CONTROL

AUXILIARY FUEL ⟶ BURNER

AIR ⟶

LIQUID OR GASEOUS
WASTE INJECTION ⟶ BURNER

PRIMARY
COMBUSTION
CHAMBER

AFTERBURNER
(SECONDARY
COMBUSTION
CHAMBER)

SPRAY
CHAMBER

HORIZONTALLY FIRED
LIQUID INJECTION
INCINERATOR

ASH

WATER
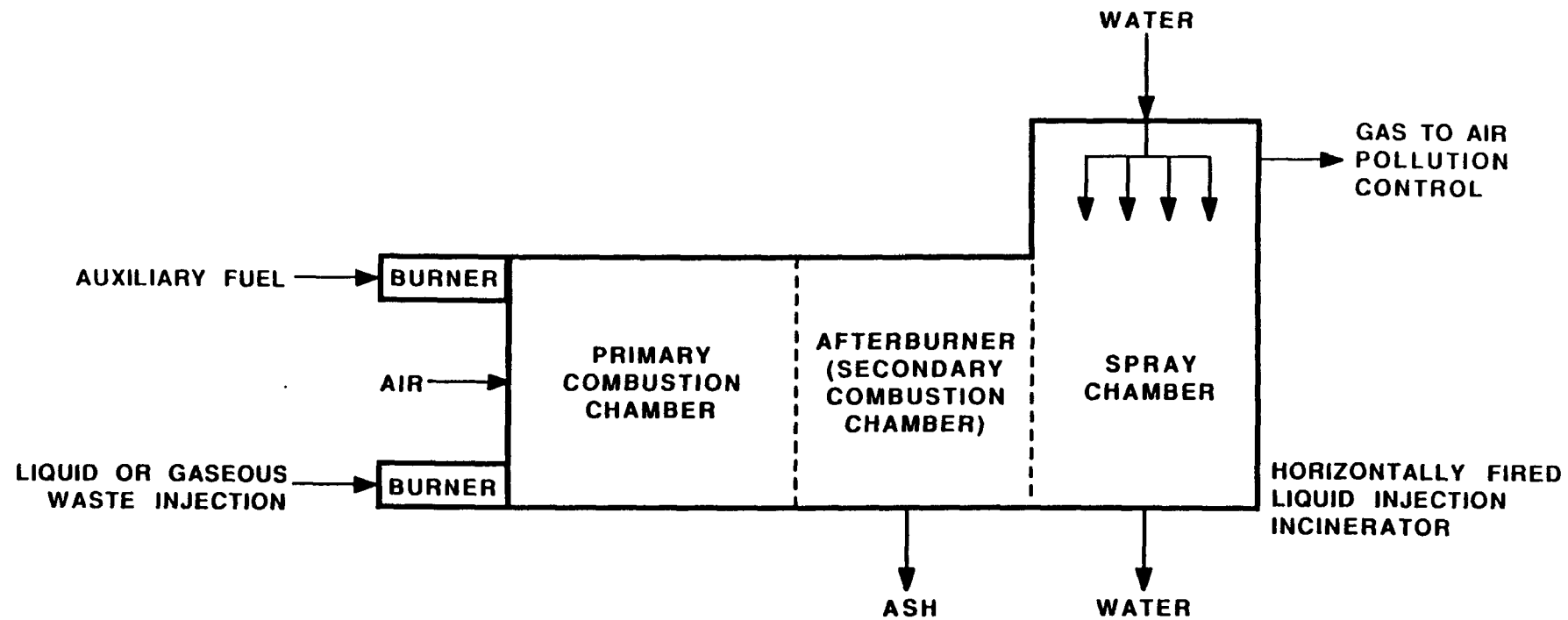
FIGURE 3-1

LIQUID INJECTION INCINERATOR
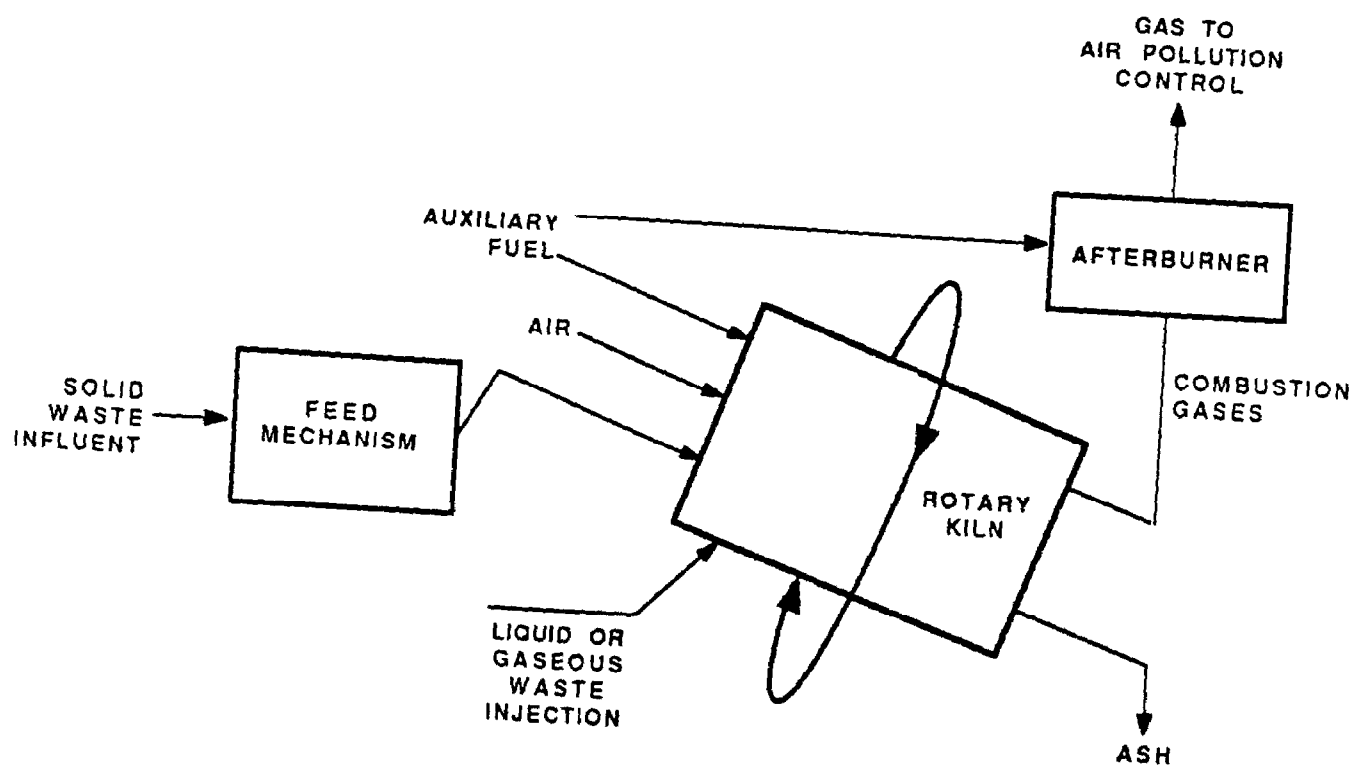
FIGURE 3-2

ROTARY KILN INCINERATOR

bed.  Continued bed agitation by the fluidizing air allows larger particles to remain suspended in the combustion zone.  (See Figure 3-3)

Fixed Hearth Incineration

Fixed hearth incinerators, also called controlled air or starved air incinerators, are another major technology used for hazardous waste incineration.  Fixed hearth incineration is a two-stage combustion process (see Figure 3-4).  Waste is ram-fed into the first stage, or primary chamber, and burned at less than stoichiometric conditions.  The resultant smoke and pyrolysis products, consisting primarily of volatile hydrocarbons and carbon monoxide, along with the normal products of combustion, pass to the secondary chamber.  Here, additional air is injected to complete the combustion.  This two-stage process generally yields low stack particulate and carbon monoxide (CO) emissions.  The primary chamber combustion reactions and combustion gas are maintained at low levels by the starved air conditions so that particulate entrainment and carryover are minimized.

Air Pollution Controls

Following incineration of hazardous wastes, combustion gases are generally further treated in an air pollution control system.  The presence of chlorine or other halogens in the waste requires a scrubbing or absorption step to remove HCl and other halo-acids from the combustion gases.  Ash in the waste is not destroyed in the combustion process.  Depending on its composition, ash will either exit as bottom ash, at the discharge end of a kiln or

GAS TO
AIR POLLUTION
CONTROL

FREEBOARD

MAKE-UP
SAND

SAND BED

WASTE
INJECTION → BURNER

AIR

ASH
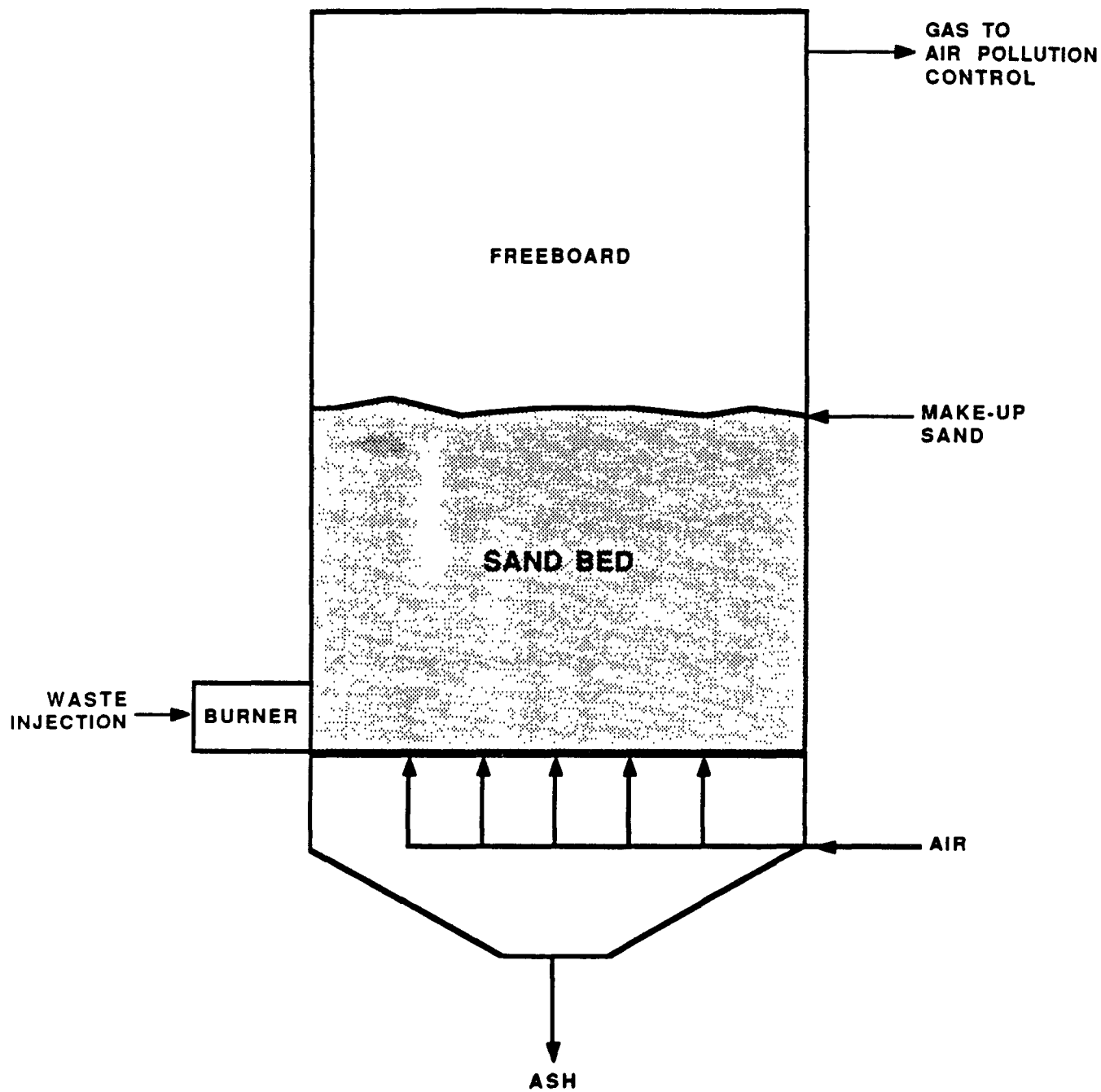
FIGURE 3-3

FLUIDIZED BED INCINERATOR

3-14

GAS TO AIR
POLLUTION
CONTROL

AIR

AIR

PRIMARY
COMBUSTION
CHAMBER

SECONDARY
COMBUSTION
CHAMBER

AUXILIARY
FUEL

WASTE
INJECTION

BURNER

GRATE

2-STAGE FIXED HEARTH
INCINERATOR

ASH
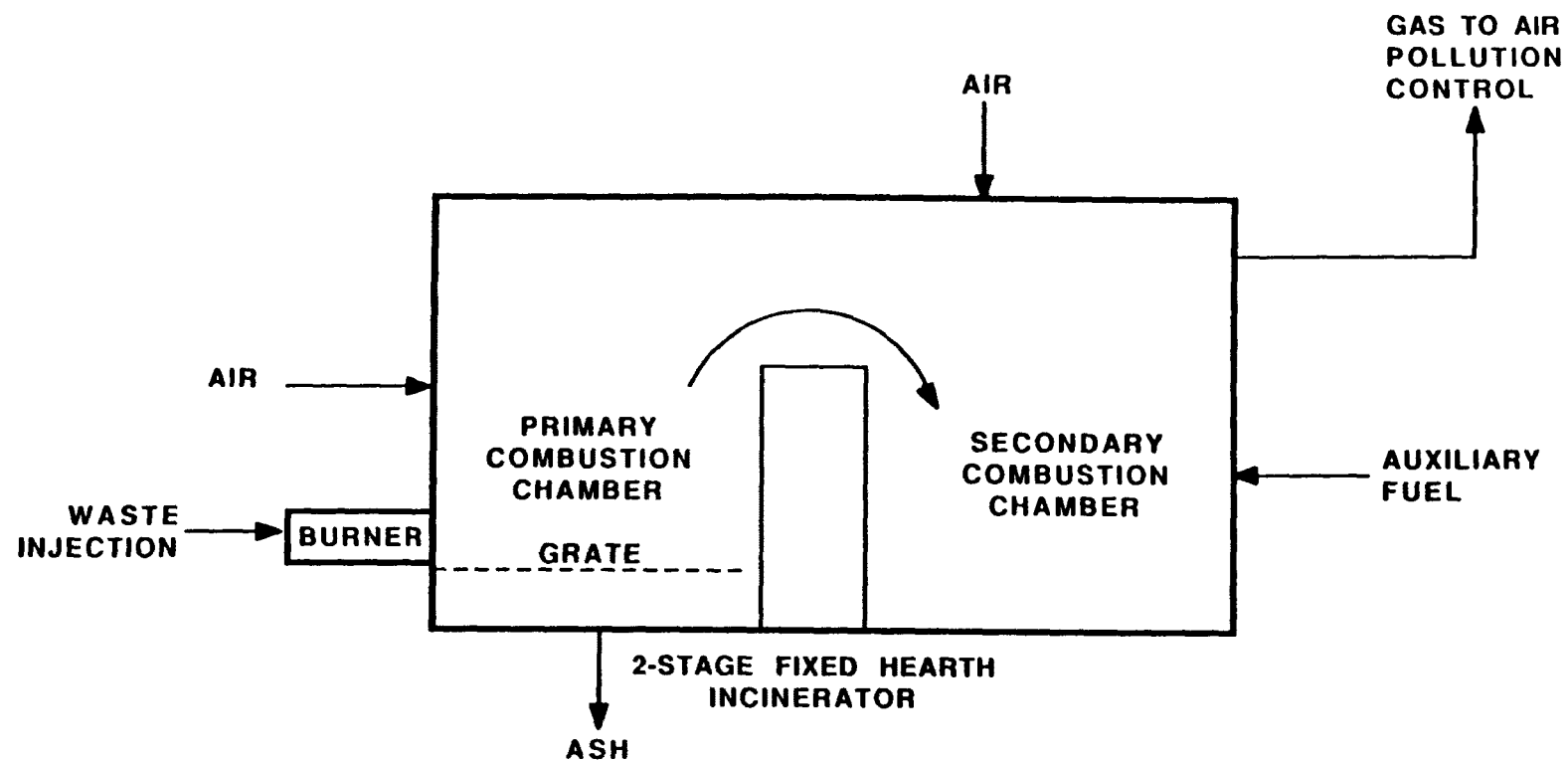
## FIGURE 3-4

## FIXED HEARTH INCINERATOR

hearth for example, or as particulate matter (fly ash) suspended in the combustion gas stream. Particulate emissions from most hazardous waste combustion systems generally have particle diameters less than one micron and require high efficiency collection devices to minimize air emissions. In addition, scrubber systems provide additional buffer against accidental releases of incompletely destroyed waste products due to poor combustion efficiency or combustion upsets, such as flame outs.

## Waste Characteristics Affecting Performance

### Liquid Injection

In determining whether liquid injection is likely to achieve the same level of performance on an untested waste as a previously tested waste, the Agency will compare bond dissociation energies of the constituents in the untested and tested waste. This parameter is being used as a surrogate indicator of activation energy which, as discussed previously, is the amount of energy required to destabilize molecular bonds. Other energy effects (e.g., vibrational, the formation of intermediates, and interactions between different molecular bonds) may have a significant influence on activation energy.

Because of the shortcomings of bond energies in estimating activation energy, EPA analyzed other waste characteristic parameters to determine if these parameters would provide a better basis for transferring

treatment standards from a tested waste to an untested waste. These param-
eters include heat of combustion, heat of formation, use of available kinetic
data to predict activation energies, and general structural class. All of
these were rejected for reasons provided below.

The heat of combustion only measures the difference in energy of the
products and reactants; it does not provide information on the transition
state (i.e., the energy input needed to initiate the reaction). Heat of
formation is used as a predictive tool for whether reactions are likely to
proceed; however, there are a significant number of hazardous constituents for
which these data are not available. Use of kinetic data were rejected because
these data are limited and could not be used to calculate free energy values
($\Delta G$) for the wide range of hazardous constituents to be addressed by this
rule. Finally, EPA decided not to use structural classes because the Agency
believes that evaluation of bond dissociation energies allows for a more
direct determination of whether a constituent will be destabilized.

Rotary Kiln/Fluidized Bed/Fixed Hearth

Unlike liquid injection, these incineration technologies also
generate a residual ash. Accordingly, in determining whether these technolo-
gies are likely to achieve the same level of performance on an untested waste
as a previously tested waste, EPA would need to examine the waste characteris-
tics that affect volatilization of organics from the waste, as well as
destruction of the organics, once volatilized. Relative to volatilization,

EPA will examine thermal conductivity of the entire waste and boiling point of the various constituents. As with liquid injection, EPA will examine bond energies in determining whether treatment standards for scrubber water residuals can be transferred from a tested waste to an untested waste. Below is a discussion of how EPA arrived at thermal conductivity and boiling point as the best method to assess volatilization of organics from the waste;

the discussion relative to bond energies is the same for these technologies as for liquid injection and will not be repeated here.

(1) Thermal Conductivity. Consistent with the underlying principles of incineration, a major factor with regard to whether a particular constituent will volatilize is the transfer of heat through the waste. In the case of rotary kiln, fluidized bed, and fixed hearth incineration, heat is transferred through the waste by three mechanisms: radiation, convection, and conduction. For a given incinerator, heat transferred through various wastes by radiation is more a function of the design and type of incinerator than the waste being treated. Accordingly, the type of waste treated will have a minimal impact on the amount of heat transferred by radiation. With regard to convection, EPA also believes that the type of heat transfer will generally be more a function of the type and design of incinerator than the waste itself. However, EPA is examining particle size as a waste characteristic that may significantly impact the amount of heat transferred to a waste by convection and thus impact volatilization of the various organic compounds. The final type of heat transfer, conduction, is the one that EPA believes will have the

greatest impact on volatilization of organic constituents. To measure this characteristic, EPA will use thermal conductivity; an explanation of this parameter, as well as how it can be measured is provided below. Heat flow by conduction is proportional to the temperature gradient across the material. The proportionality constant is a property of the material and referred to as the thermal conductivity. (Note: The analytical method that EPA has identified for measurement of thermal conductivity is named "Guarded, Comparative, Longitudinal Heat Flow Technique"; it is described in an Appendix to this technology section.) In theory, thermal conductivity would always provide a good indication of whether a constituent in an untested waste would be treated to the same extent in the primary incinerator chamber as the same constituent in a previously tested waste.

In practice, thermal conductivity has some limitations in assessing the transferability of treatment standards; however, EPA has not identified a parameter that can provide a better indication of heat transfer characteristics of a waste. Below is a discussion of both the limitations associated with thermal conductivity, as well as other parameters considered.

Thermal conductivity measurements, as part of a treatability comparison for two different wastes through a single incinerator, are most meaningful when applied to wastes that are homogeneous (i.e., major constituents are essentially the same). As wastes exhibit greater degrees of non-homogeneity (e.g., significant concentration of metals in soil), then thermal conductivity becomes less accurate in predicting treatability because the measurement

essentially reflects heat flow through regions having the greatest conductivity (i.e., the path of least resistance) and not heat flow through all parts of the waste.

Btu value, specific heat, and ash content were also considered for predicting heat transfer characteristics. These parameters can no better account for non-homogeneity than thermal conductivity; additionally, they are not directly related to heat transfer characteristics. Therefore, these parameters do not provide a better indication of heat transfer that will occur in any specific waste.

(2) Boiling Point. Once heat is (transferred to a constituent within a waste, then removal of this constituent from the waste will depend on its volatility. As a surrogate of volatility, EPA is using boiling point of the constituent. Compounds with lower boiling points have higher vapor pressures and, therefore, would be more likely to vaporize. The Agency recognizes that this parameter does not take into consideration the impact of other compounds in the waste on the boiling point of a constituent in a mixture; however, the Agency is not aware of a better measure of volatility that can easily be determined.

Incineration Design and Operating Parameters
——————————————————————————

Liquid Injection


For a liquid injection unit, EPA's analysis of whether the unit is

well designed will focus on (1) the likelihood that sufficient energy is

provided to the waste to overcome the activation level for breaking molecular

bonds and (2) whether sufficient oxygen is present to convert the waste

constituents to carbon dioxide and water vapor. The specific design param-

eters that the Agency will evaluate to assess whether these conditions are met

are: temperature, excess oxygen, and residence time. Below is a discussion

of why EPA believes these parameters to be important, as well as a discussion

of how these parameters will be monitored during operation.


It is important to point out that, relative to the development of

land disposal restriction standards, EPA is only concerned with these design

parameters when a quench water or scrubber water residual is generated from

treatment of a particular waste. If treatment of a particular waste in a

liquid injection unit would not generate a wastewater stream, then the Agency,

for purposes of land disposal treatment standards, would only be concerned

with the waste characteristics that affect selection of the unit, not the

above-mentioned design parameters.


(1) Temperature. Temperature is important in that it provides an

indirect measure of the energy available (i.e., Btus/hr) to overcome the

activation energy of waste constituents. As the design temperature increases, the more likely it is that the molecular bonds will be destabilized and the reaction completed.

The temperature is normally controlled automatically through the use of instrumentation which senses the temperature and automatically adjusts the amount of fuel and/or waste being fed. The temperature signal transmitted to the controller can be simultaneously transmitted to a recording device, referred to as a strip chart, and thereby continuously recorded. To fully assess the operation of the unit, it is important to know not only the exact location in the incinerator that the temperature is being monitored but also the location of the design temperature.

(2) Excess Oxygen. It is important that the incinerator contain oxygen in excess of the stoichiometric amount necessary to convert the organic compounds to carbon dioxide and water vapor. If insufficient oxygen is present, then destabilized waste constituents could recombine to the same or other BDAT list organic compounds and potentially cause the scrubber water to contain higher concentrations of BDAT list constituents than would be the case for a well operated unit.

In practice, the amount of oxygen fed to the incinerator is con-trolled by continuous sampling and analysis of the stack gas. If the amount of oxygen drops below the design value, then the analyzer transmits a signal to the valve controlling the air supply and thereby increases the flow of oxygen to the afterburner. The analyzer simultaneously transmits a signal to

a recording device so that the amount of excess oxygen can be continuously recorded. Again, as with temperature, it is important to know the location from which the combustion gas is being sampled.

(3) <u>Carbon Monoxide</u>. Carbon monoxide is an important operating parameter because it provides an indication of the extent to which the waste organic constituents are being converted to $CO_2$ and water vapor. As the carbon monoxide level increases, it indicates that greater amounts of organic waste constituents are unreacted or partially reacted. Increased carbon monoxide levels can result from insufficient excess oxygen, insufficient turbulence in the combustion zone, or insufficient residence time

(4) <u>Waste Feed Rate</u>. The waste feed rate is important to monitor because it is correlated to the residence time. The residence time is associated with a specific Btu energy value of the feed and a specific volume of combustion gas generated. Prior to incineration, the Btu value of the waste is determined through the use of a laboratory device known as a bomb colorimeter. The volume of combustion gas generated from the waste to be incinerated is determined from an analysis referred to as an ultimate analysis. This analysis determines the amount of elemental constituents present which include carbon, hydrogen, sulfur, oxygen, nitrogen, and halogens. Using this analysis plus the total amount of air added, the volume of combustion gas can be calculated. Having determined both the Btu content and the expected combustion gas volume, the feed rate can be fixed at the desired residence time. Continuous monitoring of the feed rate will determine whether the unit was operated at a rate corresponding to the designed residence time.

Rotary Kiln


For this incineration, EPA will examine both the primary and secon-
dary chamber in evaluating the design of a particular incinerator. Relative
to the primary chamber, EPA's assessment of design will focus on whether it is
likely that sufficient energy will be provided to the waste in order to
volatilize the waste constituents. For the secondary chamber, analogous to
the sole liquid injection incineration chamber, EPA will examine the same
parameters discussed previously under "Liquid Injection." These parameters
will not be discussed again here.


The particular design parameters to be evaluated for the primary
chamber are: kiln temperature, residence time, and revolutions per minute.
Below is a discussion of why EPA believes these parameters to be important, as
well as a discussion of how these parameters will be monitored during opera-
tion.


(1) Temperature. The primary chamber temperature is important in
that it provides an indirect measure of the energy input: (i.e., BTU/hr) that
is available for heating the waste. The higher the temperature is designed to
be in a given kiln, the more likely it is that the constituents will volatil-
ize. As discussed earlier under "Liquid Injection", temperature should be
continuously monitored and recorded. Additionally, it is important to know
the location of the temperature sensing device in the kiln.

(2) <u>Residence Time</u>. This parameter is important in that it affects whether sufficient heat is transferred to a particular constituent in order for volatilization to occur. As the time that the waste is in the kiln is increased, a greater quantity of heat is transferred to the hazardous waste constituents. The residence time will be a function of the specific configuration of the rotary kiln including the length and diameter of the kiln, the waste feed rate, and the rate of rotation.

(3) <u>Revolutions Per Minute (RPM)</u>. This parameter provides an indication of the turbulence that occurs in the primary chamber of a rotary kiln. As the turbulence increases, the quantity of heat transferred to the waste would also be expected to increase. However, as the RPM value increases, the residence time decreases resulting in a reduction of the quantity of heat transferred to the waste. This parameter needs to be carefully evaluated because it provides a balance between turbulence and residence time.

Fluidized Bed

As discussed previously, in the section on "Underlying Principles of Operation", the primary chamber accounts for almost all of the conversion of organic wastes to carbon dioxide, water vapor, and acid gas if halogens are present. The secondary chamber will generally provide additional residence time for thermal oxidation of the waste constituents. Relative to the primary chamber, the parameters that the Agency will examine in assessing the effectiveness of the design are temperature, residence time, and bed pressure

differential. The first two were discussed under rotary kiln and will not be discussed here. The latter, bed pressure differential, is important in that it provides an indication of the amount of turbulence and, therefore, indirectly the amount of heat supplied to the waste. In general, as the pressure drop increases, both the turbulence and heat supplied increase. The pressure drop through the bed should be continuously monitored and recorded to ensure that the design value is achieved.

Fixed Hearth

The design considerations for this incineration unit are similar to a rotary kiln with the exception that rate of rotation (i.e., RPM) is not an applicable design parameter. For the primary chamber of this unit, the parameters that the Agency will examine in assessing how well the unit is designed are the same as discussed under rotary kiln; for the secondary chamber (i.e., afterburner), the design and operating parameters of concern are the same as previously discussed under "Liquid Injection."

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The comparative method of measuring thermal conductivity has been proposed as an ASTM test method under the name "Guarded, Comparative, Longitudinal Heat Flow Technique". A thermal heat flow circuit is used which is the analog of an electrical circuit with resistances in series. A reference material is chosen to have a thermal conductivity close to that estimated for the sample. Reference standards (also known as heat meters) having the same cross-sectional dimensions as the sample are placed above and below the sample. An upper heater, a lower heater, and a heat sink are added to the "stack" to complete the heat flow circuit. See Figure 1.
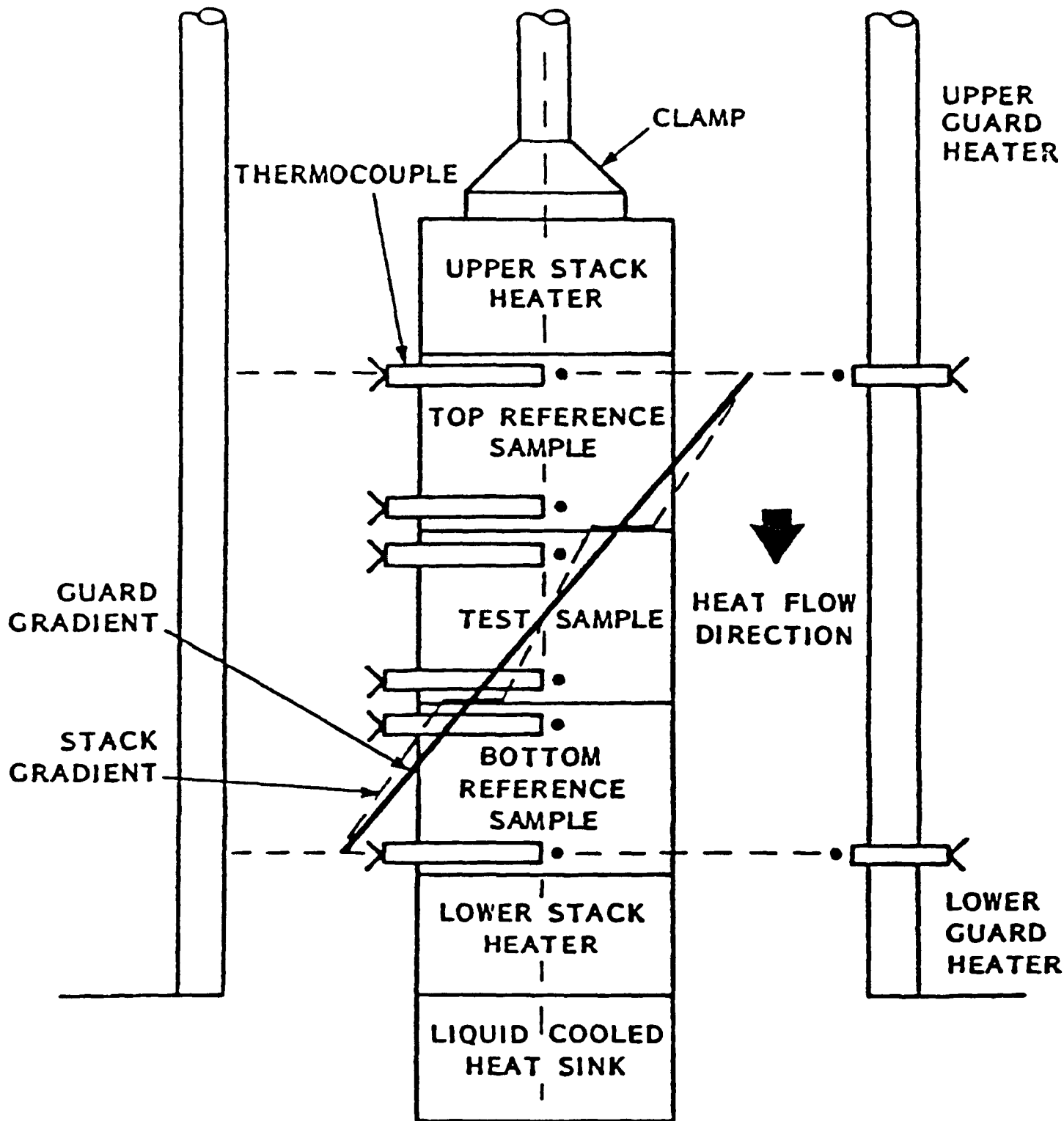
Figure 1.

SCHEMATIC DIAGRAM OF THE COMPARATIVE METHOD

The temperature gradients (analogous to potential differences) along the stack are measured with type K (chromel/alumel) thermocouples placed at known separations. The thermocouples are placed into holes or grooves in the references and also in the sample whenever the sample is thick enough to accommodate them.

For molten samples, pastes, greases, and other materials that must be contained, the material is placed into a cell consisting of a top and bottom of Pyrex 7740 and a containment ring of marinite. The sample is 2 inch in diameter and .5 inch thick. Thermocouples are not placed into the sample but rather the temperatures measured in the Pyrex are extrapolated to give the temperature at the top and bottom surfaces of the sample material. The Pyrex disks also serve as the thermal conductivity reference material.

The stack is clamped with a reproducible load to insure intimate contact between the components. In order to produce a linear flow of heat down the stack and reduce the amount of heat that flows radially, a guard tube is placed around the stack and the intervening space is filled with insulating grains or powder. The temperature gradient in the guard is matched to that in the stack to further reduce radial heat flow.

The comparative method is a steady state method of measuring thermal conductivity. When equilibrium is reached the heat flux (analogous to current flow) down the stack can be determined from the references. The heat into the sample is given by

$$Q_{in} = \lambda_{top}(dT/dx)_{top}$$

and the heat out of the sample is given by

$$Q_{out} = \lambda_{bottom}(dT/dx)_{bottom}$$

where

$$\lambda = \text{thermal conductivity}$$

$$dT/dx = \text{temperature gradient}$$

and top refers to the upper reference while bottom refers to the lower reference.  If the heat was confined to flow just down the stack, then $Q_{in}$ and $Q_{out}$ would be equal.  If $Q_{in}$ and $Q_{out}$ are in reasonable agreement, the average heat flow is calculated from

$$Q = (Q_{in} + Q_{out})/2$$

The sample thermal conductivity is then found from

January 1988

$$\lambda_{sample} = Q/(dT/dx)_{sample}$$

The result for the K102 Activated Charcoal Waste tested here is given in Table 1. The sample was held at an average temperature of 42C with a 53C temperature drop across the sample for approximately 20 hours before the temperature profile became steady and the conductivity measured. At the conclusion of the test it appeared that some "drying" of the sample had occurred.

Table 3-1

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1

| Detected BDAT List Organic Constituents | Untreated Waste | | Treated Waste |
| --- | --- | --- | --- |
| | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) |
| VOLATILES | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 4,000 | <8 | <2 |
| 9. Chlorobenzene | 3,000 | <8 | <2 |
| 14. Chloroform | 4,600 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | 5,300 | <40 | <10 |
| 22. 1,1-Dichloroethane | 2,200 | <8 | <2 |
| 23. 1,2-Dichloroethane | 93,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <1,000 | 940 | <10 |
| 38. Methylene chloride | <1,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | 1,400 | <8 | <2 |
| 42. Tetrachloroethene | 7,300 | 490 | <2 |
| 43. Toluene | <200 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 81,000 | 130 | <2 |
| 47. Trichloroethene | 3,210 | 360 | <2 |
| 215-217. Xylene (total) | <200 | 3,400 | <2 |
| 222. Acetone | <1,000 | 1,200 | <10 |
| 226. Ethyl benzene | <200 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <1,000 | 1,100 | <10 |
| SEMIVOLATILES | | | |
| 51. Acenaphthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 280 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | <2 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 81 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | <2 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 20 | 53 | <2 |
| 110. Hexachlorobenzene | 69 | <100 | <10 |

SNA  A standard is not available; the compound was searched using an NBS Library data-
base of 42,000 compounds.  The compound was not detected.
*  Only one sample of RCRA Blend waste was taken.  The results are repeated in each
sample set.

Table 3-1 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

| | Untreated Waste | | Treated Waste | |
|---|---|---|---|---|
| | K019 Concentration | RCRA Blend* Concentration | Kiln Ash Concentration | Kiln Ash TCLP |
| Detected BDAT List Organic Constituents | mg/kg (ppm) | mg/kg (ppm) | mg/kg (ppm) | mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 120 | <100 | <10 | |
| 121. Naphthalene | 470 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 61 | <100 | <10 | |
| 141. Phenanthrene | 21 | 240 | <2 | |
| 142. Phenol | <10 | 178 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 76 | <50 | <5 | |
| 150. 1,2,4-Trichlorobenzene | 100 | <50 | <5 | |
| Detected BDAT List Metal and Inorganic Constituents | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | 8.0 | <0.060 |
| 155. Arsenic | 1.2 | 94 | 3.6 | <0.002 |
| 156. Barium | 0.97 | 1.3 | 26 | 0.033 |
| 158. Cadmium | 0.63 | <0.3 | 0.66 | <0.003 |
| 159. Chromium | 4.0 | 40 | 44 | 0.200 |
| 160. Copper | 2.1 | 165 | 2,370 | 2.690 |
| 161. Lead | 3.4 | 27 | 120 | 0.380 |
| 163. Nickel | 3.0 | 8.8 | 66 | 0.680 |
| 165. Silver | <0.9 | <0.9 | 3.3 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | 4.1 | <0.020 |
| 168. Zinc | 5.8 | 4,170 | 12 | 0.052 |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 38 | |
| 171. Sulfide | 790 | 830 | 68 | |

*Only one sample of RCRA Blend waste was taken. The results are repeated in each
sample set.

Table 3-1 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|---|---|---|
| Kiln Temperature ($^{O}F$)+ | * | 1825-1900 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | K019:  13.1 |
|  |  | RCRA Blend Waste Burner #1: 3.9-5.5 |
|  |  | RCRA Blend Waste Burner #2: 4.4-9.7 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information.  The
information is available in the confidential portion of the Administrative Record for
this rulemaking.

Table 3-2

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2

| Detected BDAT List Organic Constituents | Untreated Waste | | Treated Waste |
| --- | --- | --- | --- |
| | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) |
| **VOLATILES** | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 3,800 | <8 | <2 |
| 9. Chlorobenzene | <2,000 | <8 | <2 |
| 14. Chloroform | 5,800 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2 |
| 23. 1,2-Dichloroethane | 96,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10 |
| 38. Methylene chloride | <10,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2 |
| 42. Tetrachloroethene | 6,700 | 490 | <2 |
| 43. Toluene | <2,000 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 33,000 | 130 | <2 |
| 47. Trichloroethene | 2,400 | 360 | <2 |
| 215-217. Xylene (total) | <2,000 | 3,400 | <2 |
| 222. Acetone | <10,000 | 1,200 | <10 |
| 226. Ethyl benzene | <2,000 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10 |
| **SEMIVOLATILES** | | | |
| 51. Acenaphthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 280 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | <2 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 74 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | <2 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 16 | 53 | <2 |
| 110. Hexachlorobenzene | 60 | <100 | <10 |

SNA A standard is not available; the compound was searched using an NBS Library data-
base of 42,000 compounds. The compound was not detected.
  * Only one sample of RCRA Blend waste was taken. The results are repeated in each
sample set.

Table 3-2 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

| | Untreated Waste | | Treated Waste | |
|---|---|---|---|---|
| | K019 Concentration | RCRA Blend* Concentration | Kiln Ash Concentration | Kiln Ash TCLP |
| Detected BDAT List Organic Constituents | mg/kg (ppm) | mg/kg (ppm) | mg/kg (ppm) | mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 85 | <100 | <10 | |
| 121. Naphthalene | 314 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 51 | <100 | <10 | |
| 141. Phenanthrene | 15 | 240 | <2 | |
| 142. Phenol | <10 | 78 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 62 | <50 | <5 | |
| 150. 1,2,4-Trichlorobenzene | 65 | <50 | <5 | |
| Detected BDAT List Metal and Inorganic Constituents | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | 6.8 | <0.060 |
| 155. Arsenic | <0.2 | 94 | 2.8 | <0.002 |
| 156. Barium | <0.9 | 1.3 | 23 | 0.036 |
| 158. Cadmium | 0.46 | <0.3 | 0.96 | 0.004 |
| 159. Chromium | 3.4 | 40 | 60 | 0.130 |
| 160. Copper | 1.7 | 165 | 3,430 | 2.380 |
| 161. Lead | 2.3 | 27 | 42 | 0.260 |
| 163. Nickel | 3.6 | 8.8 | 89 | 0.560 |
| 165. Silver | <0.9 | <0.9 | 3.4 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | 4.8 | <0.020 |
| 168. Zinc | 6.9 | 4,170 | 13 | 0.071 |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 5.1 | |
| 171. Sulfide | NA | 830 | <50 | |

NA Not Analyzed.

*Only one sample of RCRA Blend waste was taken.  The results are repeated in each
 sample set.

Table 3-2 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|---|---|---|
| Kiln Temperature ($^O$F)+ | * | 1800-1880 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | K019:  12.2 |
| | | RCRA Blend Waste Burner #1: 5.2-5.5 |
| | | RCRA Blend Waste Burner #2: 4.4-9.7 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3

| | Untreated Waste | | Treated Waste |
|---|---|---|---|
| Detected BDAT List Organic Constituents | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) |
| VOLATILES | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 3,500 | <8 | <2 |
| 9. Chlorobenzene | <2,000 | <8 | <2 |
| 14. Chloroform | 5,000 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | <2,000 | <40 | <10 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2 |
| 23. 1,2-Dichloroethane | 87,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10 |
| 38. Methylene chloride | <10,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2 |
| 42. Tetrachloroethene | 6,000 | 490 | <2 |
| 43. Toluene | <2,000 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 34,000 | 130 | <2 |
| 47. Trichloroethene | 2,200 | 360 | <2 |
| 215-217. Xylene (total) | <2,000 | 3,400 | <2 |
| 222. Acetone | <10,000 | 1,200 | <10 |
| 226. Ethyl benzene | <2,000 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10 |
| SEMIVOLATILES | | | |
| 51. Acenaphthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 290 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | <2 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 80 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | <2 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 19 | 53 | <2 |
| 110. Hexachlorobenzene | 73 | <100 | <10 |

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.
 * Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 3-3 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

| | Untreated Waste | | Treated Waste | |
|---|---|---|---|---|
| Detected BDAT List Organic Constituents | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) | Kiln Ash TCLP mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 95 | <100 | <10 | |
| 121. Naphthalene | 350 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 59 | <100 | <10 | |
| 141. Phenanthrene | 11 | 240 | <2 | |
| 142. Phenol | <10 | 78 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 67 | <50 | 5 | |
| 150. 1,2,4-Trichlorobenzene | 70 | <50 | <5 | |
| Detected BDAT List Metal and Inorganic Constituents | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | 9.2 | <0.060 |
| 155. Arsenic | <0.2 | 94 | 5.7 | <0.002 |
| 156. Barium | <0.9 | 1.3 | 54 | 0.057 |
| 158. Cadmium | 0.53 | <0.3 | 3.6 | 0.005 |
| 159. Chromium | 3.5 | 40 | 202 | 0.260 |
| 160. Copper | 1.7 | 165 | 2,290 | 7.030 |
| 161. Lead | 3.4 | 27 | 118 | 0.620 |
| 163. Nickel | 2.3 | 8.8 | 169 | 0.960 |
| 165. Silver | <0.9 | <0.9 | 1.9 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | 6.0 | <0.020 |
| 168. Zinc | 4.4 | 4,170 | 16 | 0.170 |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 6.1 | |
| 171. Sulfide | NA | 830 | 64 | |

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 3-3 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)


DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|---|---|---|
| Kiln Temperature ($^{O}$F)+ | * | 1850-1900 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | K019:   12.4 |
| | | RCRA Blend Waste Burner #1: 5.2-5.8 |
| | | RCRA Blend Waste Burner #2: 4.4-8.4 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |


+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information.  The
information is available in the confidential portion of the Administrative Record for
this rulemaking.

Table 3-4

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4

| Detected BDAT List<br>Organic Constituents | Untreated Waste | | Treated Waste |
| --- | --- | --- | --- |
| | K019<br>Concentration<br>mg/kg<br>(ppm) | RCRA Blend*<br>Concentration<br>mg/kg<br>(ppm) | Kiln Ash<br>Concentration<br>mg/kg<br>(ppm) |
| VOLATILES | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 3,900 | <8 | <2 |
| 9. Chlorobenzene | <2,000 | <8 | <2 |
| 14. Chloroform | 5,300 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2 |
| 23. 1,2-Dichloroethane | 122,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10 |
| 38. Methylene chloride | <10,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2 |
| 42. Tetrachloroethene | 7,200 | 490 | <2 |
| 43. Toluene | <2,000 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 44,000 | 130 | <2 |
| 47. Trichloroethene | 2,300 | 360 | <2 |
| 215-217. Xylene (total) | <2,000 | 3,400 | <2 |
| 222. Acetone | <10,000 | 1,200 | <10 |
| 226. Ethyl benzene | <2,000 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10 |
| SEMIVOLATILES | | | |
| 51. Acenaphthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 310 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | 12 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 84 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | 230 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 21 | 53 | <2 |
| 110. Hexachlorobenzene | 61 | <100 | <10 |

SNA A standard is not available; the compound was searched using an NBS Library data-
base of 42,000 compounds. The compound was not detected.
*Only one sample of RCRA Blend waste was taken. The results are repeated in each
sample set.

Table 3-4 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

| | Untreated Waste | | Treated Waste | |
| | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) | Kiln Ash TCLP mg/L (ppm) |
|---|---|---|---|---|
| **Detected BDAT List Organic Constituents** | | | | |
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 94 | <100 | <10 | |
| 121. Naphthalene | 360 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 64 | <100 | <10 | |
| 141. Phenanthrene | 19 | 240 | <2 | |
| 142. Phenol | <10 | 78 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 82 | <50 | <5 | |
| 150. 1,2,4-Trichlorobenzene | 74 | <50 | <5 | |
| **Detected BDAT List Metal and Inorganic Constituents** | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | <6.0 | <0.060 |
| 155. Arsenic | <0.2 | 94 | 5.7 | <0.002 |
| 156. Barium | <0.9 | 1.3 | 8.4 | 0.036 |
| 158. Cadmium | <0.3 | <0.3 | <0.3 | 0.005 |
| 159. Chromium | 1.8 | 40 | 28 | 0.110 |
| 160. Copper | <1.0 | 165 | 1,270 | 1.940 |
| 161. Lead | 2.4 | 27 | 25 | 0.320 |
| 163. Nickel | 2.2 | 8.8 | 6.9 | 0.870 |
| 165. Silver | <0.9 | <0.9 | 2.6 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | <2.0 | <0.020 |
| 168. Zinc | 9.4 | 4,170 | 11 | 0.056 |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 3.2 | |
| 171. Sulfide | NA | 830 | <50 | |

NA = Not Analyzed.

* Only one sample of RCRA Blend waste was taken. The results are repeated in each
  sample set.

Table 3-4 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR KO19
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

## DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|---|---|---|
| Kiln Temperature ($^O$F)+ | * | 1775-1900 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | KO19:  12.7 |
| | | RCRA Blend Waste Burner #1: 5.2-5.8 |
| | | RCRA Blend Waste Burner #2: 4.4-7.3 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |

+ Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR KO19
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5

| Detected BDAT List Organic Constituents | Untreated Waste | | Treated Waste |
| | KO19 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) |
| --- | --- | --- | --- |
| VOLATILES | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 4,000 | <8 | <2 |
| 9. Chlorobenzene | <2,000 | <8 | <2 |
| 14. Chloroform | 6,000 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2 |
| 23. 1,2-Dichloroethane | 130,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10 |
| 38. Methylene chloride | <10,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2 |
| 42. Tetrachloroethene | 7,800 | 490 | <2 |
| 43. Toluene | <2,000 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 45,000 | 130 | <2 |
| 47. Trichloroethene | 2,500 | 360 | <2 |
| 215-217. Xylene (total) | <2,000 | 3,400 | <2 |
| 222. Acetone | <10,000 | 1,200 | <10 |
| 226. Ethyl benzene | <2,000 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10 |
| | | | |
| SEMIVOLATILES | | | |
| 51. Acenaphthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 340 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | <2 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 90 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | <2 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 19 | 53 | <2 |
| 110. Hexachlorobenzene | 87 | <100 | <10 |

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.

 * Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 3-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

| | Untreated Waste | | Treated Waste | |
| | K019 Concentration | RCRA Blend* Concentration | Kiln Ash Concentration | Kiln Ash TCLP |
| Detected BDAT List Organic Constituents | mg/kg (ppm) | mg/kg (ppm) | mg/kg (ppm) | mg/L (ppm) |
|---|---|---|---|---|
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 113 | <100 | <10 | |
| 121. Naphthalene | 371 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 63 | <100 | <10 | |
| 141. Phenanthrene | 19 | 240 | <2 | |
| 142. Phenol | <10 | 78 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 73 | <50 | <5 | |
| 150. 1,2,4-Trichlorobenzene | 72 | <50 | <5 | |
| | | | | |
| Detected BDAT List Metal and Inorganic Constituents | | | | |
| | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | 9.1 | <0.060 |
| 155. Arsenic | <0.2 | 94 | 3.9 | <0.002 |
| 156. Barium | <0.9 | 1.3 | 21 | 0.054 |
| 158. Cadmium | 0.36 | <0.3 | 1.2 | 0.006 |
| 159. Chromium | 3.2 | 40 | 125 | 0.210 |
| 160. Copper | 2.1 | 165 | 2,780 | 2.140 |
| 161. Lead | 2.5 | 27 | 86 | 0.290 |
| 163. Nickel | 4.8 | 8.8 | 166 | 1.270 |
| 165. Silver | <0.9 | <0.9 | 3.3 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | 5.7 | <0.020 |
| 168. Zinc | 4.7 | 4,170 | 22 | 0.086 |
| | | | | |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 23 | |
| 171. Sulfide | NA | 830 | 64 | |

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 3-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|-----------|--------|-----------------|
| Kiln Temperature ($^O$F)+ | * | 1775-1800 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | K019:  11.7 |
| | | RCRA Blend Waste Burner #1: 5.5-6.0 |
| | | RCRA Blend Waste Burner #2: 5.2-9.7 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information.  The
information is available in the confidential portion of the Administrative Record for
this rulemaking.

Table 3-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6

| Detected BDAT List Organic Constituents | Untreated Waste | | Treated Waste |
| | K019 Concentration mg/kg (ppm) | RCRA Blend* Concentration mg/kg (ppm) | Kiln Ash Concentration mg/kg (ppm) |
|---|---|---|---|
| VOLATILES | | | |
| 4. Benzene | <2,000 | 2,000 | <2 |
| 7. Carbon tetrachloride | 4,100 | <8 | <2 |
| 9. Chlorobenzene | <2,000 | <8 | <2 |
| 14. Chloroform | 5,600 | <8 | <2 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2 |
| 23. 1,2-Dichloroethane | 98,000 | <8 | <2 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10 |
| 38. Methylene chloride | <10,000 | 910 | <10 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2 |
| 42. Tetrachloroethene | 6,900 | 490 | <2 |
| 43. Toluene | <2,000 | 2,300 | <2 |
| 45. 1,1,1-Trichloroethane | 44,000 | 130 | <2 |
| 47. Trichloroethene | 2,500 | 360 | <2 |
| 215-217. Xylene (total) | <2,000 | 3,400 | <2 |
| 222. Acetone | <10,000 | 1,200 | <10 |
| 226. Ethyl benzene | <2,000 | 2,200 | <2 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10 |
| | | | |
| SEMIVOLATILES | | | |
| 51. Acenapthalene | <10 | 150 | <2 |
| 57. Anthracene | <10 | 110 | <2 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <2 |
| 68. Bis(2-chloroethyl) ether | 330 | <20 | <2 |
| 70. Bis(2-ethylhexyl) phthalate | <10 | 40 | <2 |
| 80. Chrysene | SNA | 28 | <2 |
| 87. o-Dichlorobenzene | <10 | 250 | <2 |
| 88. p-Dichlorobenzene | 90 | 32 | <2 |
| 98. Di-n-butyl phthalate | <10 | 31 | <2 |
| 108. Fluoranthene | <10 | 120 | <2 |
| 109. Fluorene | 22 | 53 | <2 |
| 110. Hexachlorobenzene | 66 | <100 | <10 |

SNA A standard is not available; the compound was searched using an NBS Library database of 42,000 compounds. The compound was not detected.
 * Only one sample of RCRA Blend waste was taken. The results are repeated in each sample set.

Table 3-6 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

| | Untreated Waste | | Treated Waste | |
|---|---|---|---|---|
| | K019 | RCRA Blend* | Kiln Ash | Kiln Ash |
| | Concentration | Concentration | Concentration | TCLP |
| Detected BDAT List | mg/kg | mg/kg | mg/kg | mg/L |
| Organic Constituents | (ppm) | (ppm) | (ppm) | (ppm) |
| | | | | |
| SEMIVOLATILES (Continued) | | | | |
| 111. Hexachlorobutadiene | <50 | 210 | <10 | |
| 113. Hexachloroethane | 88 | <100 | <10 | |
| 121. Naphthalene | 390 | <20 | <2 | |
| 126. Nitrobenzene | <25 | 3,400 | <5 | |
| 136. Pentachlorobenzene | 65 | <100 | <10 | |
| 141. Phenanthrene | 17 | 240 | <2 | |
| 142. Phenol | <10 | 78 | <2 | |
| 145. Pyrene | <10 | 200 | <2 | |
| 148. 1,2,4,5-Tetrachlorobenzene | 86 | <50 | <5 | |
| 150. 1,2,4-Trichloroenzene | 79 | <50 | <5 | |
| | | | | |
| Detected BDAT List Metal | | | | |
| and Inorganic Constituents | | | | |
| | | | | |
| METALS | | | | |
| 154. Antimony | <6.0 | 24 | 9.6 | < 0.06 |
| 155. Arsenic | <0.2 | 94 | 2.3 | <0.002 |
| 156. Barium | <0.9 | 1.3 | 11 | 0.027 |
| 158. Cadmium | 0.62 | <0.3 | 2.2 | 0.006 |
| 159. Chromium | 5.3 | 40 | 141 | 0.092 |
| 160. Copper | 3.6 | 165 | 2,520 | 2.400 |
| 161. Lead | 3.5 | 27 | 34 | 0.270 |
| 163. Nickel | 6.0 | 8.8 | 288 | 0.690 |
| 165. Silver | <0.9 | <0.9 | 3.1 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | 8.7 | <0.020 |
| 168. Zinc | 8.4 | 4,170 | 13 | 0.061 |
| | | | | |
| INORGANICS | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.47 | |
| 170. Fluoride | <5.0 | 31 | 4.7 | |
| 171. Sulfide | NA | 830 | 92 | |

NA = Not Analyzed.

*Only one sample of RCRA Blend waste was taken.  The results are repeated in each
 sample set.

Table 3-6 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

DESIGN AND OPERATING PARAMETERS

| Parameter | Design | Operating Value |
|---|---|---|
| Kiln Temperature (°F)+ | * | 1775-1850 |
| Kiln Solids Residence Time (min) | * | 120 |
| Waste Feed Rate (MMBTU/hr)+ | * | K019:  11.5 |
| | | RCRA Blend Waste Burner #1: 5.2-5.8 |
| | | RCRA Blend Waste Burner #2: 5.2-9.7 |
| Kiln Rotational Speed (RPM) | * | 0.19-0.21 |

+Strip charts for this parameter are included in Appendix C.

*This information has been claimed as RCRA Confidential Business Information.  The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-7

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #1

| | Untreated Waste Concentration | | | | Treated Waste |
| Detected BDAT List Organic Constituents | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
|---|---|---|---|---|---|
| **VOLATILES** | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 4,000 | <8 | <2,000 | 1.90 | <0.002 |
| 9. Chlorobenzene | 3,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 4,600 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butene | 5,300 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <200 | <8 | <2,000 | <0.4 | <0.002 |
| 22. 1,1-Dichloroethane | 2,200 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 93,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <1,000 | 940 | <10,000 | 3.5 | <0.01 |
| 38. Methylene chloride | <1,000 | 910 | 5,900 | <2.0 | <0.01 |
| 41. 1,1,2,2-Tetrachloroethane | 1,400 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 7,300 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <200 | 2,300 | 41,000 | 3.7 | <0.002 |
| 45. 1,1,1-Trichloroethane | 81,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 3,210 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <200 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <1,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <200 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <1,000 | 1,100 | <10,000 | <2 | <0.01 |
| **SEMIVOLATILES** | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 280 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.002 |

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-7 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #1 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan- Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | <0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 81 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.002 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 20 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 69 | <100 | <500 | 0.022 | <0.010 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.010 |
| 113. Hexachloroethane | 120 | <100 | <500 | 0.018 | <0.010 |
| 121. Naphthalene | 470 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 61 | <100 | 1,000 | 0.020 | <0.010 |
| 141. Phenanthrene | 21 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 76 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 100 | <50 | 19,000 | 1.24 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.010 |

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-7 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #1 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| METALS | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.41 |
| 155. Arsenic | 1.2 | 94 | 7.4 | <0.02 | 0.046 |
| 156. Barium | 0.97 | 1.3 | <19 | 1.670 | 0.48 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | 0.001 |
| 158. Cadmium | 0.63 | <0.3 | <33 | 0.003 | 0.23 |
| 159. Chromium | 4.0 | 40 | 23.7 | <0.009 | 0.11 |
| 160. Copper | 2.1 | 165 | 107 | 0.027 | 1.81 |
| 161. Lead | 3.4 | 27 | <7.3 | 0.0064 | 0.82 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.002 |
| 163. Nickel | 3.0 | 8.8 | 6.2 | 0.037 | 0.081 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | 0.085 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.020 | 0.16 |
| 168. Zinc | 5.8 | 4,170 | 6810 | 0.071 | 11.4 |
| INORGANICS | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 0.010 | <0.01 |
| 170. Fluoride | <5.0 | 31 | 15 | 0.950 | 20.0 |
| 171. Sulfide | 790 | 830 | 16,000 | 17.0 | <1.0 |
| PCBs | | | | | |
| 206. Aroclor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-7 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #1 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature ($^{O}F$)[+] | * | 2380 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)[+] | * | PCB Blend Feed Rate:  36.1 Mercaptan-Contaminated Waste Feed Rate:  0.18 |
| Excess Oxygen Concentration (%)+ | | 6.8 |
| Carbon Monoxide Concentration (ppm volume) | | NR |

NR Not Recorded.

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information.  The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-8

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #2

| | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| Detected BDAT List Organic Constituents | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| VOLATILES | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 3,800 | <8 | <2,000 | 1.9 | <0.002 |
| 9. Chlorobenzene | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 5,800 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butadiene | <10,000 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 96,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 | <0.010 |
| 38. Methylene chloride | <10,000 | 910 | 5,900 | <2.0 | <0.010 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 6,700 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <2,000 | 2,300 | 41,000 | 3.7 | 0.0032 |
| 45. 1,1,1-Trichloroethane | 33,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 2,400 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2 | <0.01 |
| SEMIVOLATILES | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 280 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.002 |

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-8 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #2 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
| --- | --- | --- | --- | --- | --- |
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | 0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 74 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.063 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 16 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 60 | <100 | <500 | 0.022 | <0.010 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.010 |
| 113. Hexachloroethane | 85 | <100 | <500 | 0.018 | <0.010 |
| 121. Naphthalene | 314 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 51 | <100 | 1,000 | 0.020 | <0.010 |
| 141. Phenanthrene | 15 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 62 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 65 | <50 | 19,000 | 1.24 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.010 |

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000
 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-8 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #2 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
| --- | --- | --- | --- | --- | --- |
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| METALS | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.39 |
| 155. Arsenic | <0.2 | 94 | 7.9 | <0.02 | 0.038 |
| 156. Barium | <0.9 | 1.3 | <19 | 1.670 | 0.50 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | <0.001 |
| 158. Cadmium | 0.46 | 0.3 | <33 | <0.003 | 0.19 |
| 159. Chromium | 3.4 | 40 | 23.7 | <0.009 | 0.14 |
| 160. Copper | 1.7 | 165 | 107 | 0.027 | 1.38 |
| 161. Lead | 2.3 | 27 | <7.3 | 0.0064 | 0.78 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.0026 |
| 163. Nickel | 3.6 | 8.8 | 6.2 | 0.037 | 0.068 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | 0.095 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.02 | 0.18 |
| 168. Zinc | 6.9 | 4,170 | 6810 | 0.071 | 11.0 |
| INORGANICS | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 0.010 | <0.01 |
| 170. Fluoride | <5.0 | 31 | 15 | 0.950 | 15.0 |
| 171. Sulfide | NA | 830 | 16,000 | 17.0 | <1.0 |
| PCBs | | | | | |
| 206. Aroclor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken.  The results are repeated in each sample set.

Table 3-8 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #2 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature (°F)[+] | * | 2400 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)[+] | * | PCB Blend Feed Rate: 36.5 |
| | | Mercaptan-Contaminated Waste |
| | | Feed Rate: 0.18 |
| Excess Oxygen Concentration (%)[+] | | 7.0 |
| Carbon Monoxide Concentration (ppm volume) | | NR |

NR Not Recorded.

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information. The
 information is available in the confidential portion of the Administrative Record for
 this rulemaking.

Table 3-9

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR KO19
PLANT A - AFTERBURNER

SAMPLE SET #3

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | KO19 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| VOLATILES | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 3,500 | <8 | <2,000 | 1.9 | <0.002 |
| 9. Chlorobenzene | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 5.000 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <2,000 | <8 | <2,000 | <0.4 | 0.0043 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 87,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 | <0.01 |
| 38. Methylene chloride | <10,000 | 910 | 5,900 | <2.0 | <0.01 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 6,000 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <2,000 | 2,300 | 41,000 | 3.7 | 0.0026 |
| 45. 1,1,1-Trichloroethane | 34,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 2,200 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2 | <0.01 |
| SEMIVOLATILES | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 290 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.002 |

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-9 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #3 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | 0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 80 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.0046 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 19 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 73 | <100 | <500 | 0.022 | <0.01 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.01 |
| 113. Hexachloroethane | 95 | <100 | <500 | 0.018 | <0.01 |
| 121. Naphthalene | 350 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 59 | <100 | 1,000 | 0.020 | <0.010 |
| 141. Phenanthrene | 11 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 67 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 70 | <50 | 19,000 | 1.240 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.010 |

SNA  A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-9 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #3 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| **METALS** | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.41 |
| 155. Arsenic | <0.2 | 94 | 7.4 | <0.02 | 0.030 |
| 156. Barium | <0.9 | 1.3 | <19 | 1.670 | 0.530 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | <0.001 |
| 158. Cadmium | 0.53 | <0.3 | <33 | 0.003 | 0.150 |
| 159. Chromium | 3.5 | 40 | 23.7 | <0.009 | 0.13 |
| 160. Copper | 1.7 | 165 | 107 | 0.027 | 1.18 |
| 161. Lead | 3.4 | 27 | <7.3 | 0.0064 | 0.64 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.0015 |
| 163. Nickel | 2.3 | 8.8 | 6.2 | 0.037 | 0.057 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | <0.009 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.02 | 0.150 |
| 168. Zinc | 4.4 | 4,170 | 6810 | 0.071 | 9.50 |
| **INORGANICS** | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 0.010 | <0.01 |
| 170. Fluoride | <5.0 | 31 | 15 | 0.950 | 14.0 |
| 171. Sulfide | NA | 830 | 16,000 | 17.0 | <1.0 |
| **PCBs** | | | | | |
| 206. Arochlor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-9 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #3 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature ($^O$F)[+] | * | 2400 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)[+] | * | PCB Blend Feed Rate: 36.5 Mercaptan-Contaminated Waste Feed Rate: 0.18 |
| Excess Oxygen Concentration (%)[+] | | 7.2 |
| Carbon Monoxide Concentration (ppm volume)[+] | | 0 |

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-10

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #4

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| VOLATILES | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 3,900 | <8 | <2,000 | 1.9 | <0.002 |
| 9. Chlorobenzene | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 5,300 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butadiene | <10,000 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <2,000 | <8 | <2,000 | <0.4 | 0.014 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 122,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 | <0.01 |
| 38. Methylene chloride | <10,000 | 910 | 5,900 | <2.0 | <0.01 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 7,200 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <2,000 | 2,300 | 41,000 | 3.7 | 0.0046 |
| 45. 1,1,1-Trichloroethane | 44,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 2,300 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2 | <0.01 |
| SEMIVOLATILES | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 310 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.002 |

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-10 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #4 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | 0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 84 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.0042 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 21 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 61 | <100 | <500 | 0.022 | <0.010 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.010 |
| 113. Hexachloroethane | 94 | <100 | <500 | 0.018 | <0.010 |
| 121. Naphthalene | 360 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 64 | <100 | 1,000 | 0.020 | <0.010 |
| 141. Phenanthrene | 19 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 82 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 74 | <50 | 19,000 | 1.240 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.010 |

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

3-64

Table 3-10 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #4 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan- Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| METALS | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.4 |
| 155. Arsenic | <0.2 | 94 | 7.4 | <0.02 | 0.029 |
| 156. Barium | <0.9 | 1.3 | <19 | 1.670 | 0.55 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | <0.001 |
| 158. Cadmium | <0.3 | <0.3 | <33 | 0.003 | 0.13 |
| 159. Chromium | 1.8 | 40 | 23.7 | <0.009 | 0.14 |
| 160. Copper | <1.0 | 165 | 107 | 0.027 | 1.13 |
| 161. Lead | 2.4 | 27 | <7.3 | 0.0064 | 0.600 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.0004 |
| 163. Nickel | 2.2 | 8.8 | 6.2 | 0.037 | 0.065 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | 0.092 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.02 | 0.150 |
| 168. Zinc | 9.4 | 4,170 | 6810 | 0.071 | 9.98 |
| INORGANICS | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 0.010 | <0.01 |
| 170. Fluoride | 5.0 | 31 | 15 | 0.950 | 13.0 |
| 171. Sulfide | NA | 830 | 16,000 | 17.0 | <1.0 |
| PCBs | | | | | |
| 206. Aroclor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-10 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #4 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature ($^{O}F$)[+] | * | 2400 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)[+] | * | PCB Blend Feed Rate:  36.5 Mercaptan-Contaminated Waste Feed Rate:  0.18 |
| Excess Oxygen Concentration (%)[+] | | 6.4 |
| Carbon Monoxide Concentration (ppm volume)[+] | | 0 |

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information.  The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-11

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #5

| | Untreated Waste Concentration | | | | Treated Waste |
| Detected BDAT List Organic Constituents | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
|---|---|---|---|---|---|
| **VOLATILES** | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 4,000 | <8 | <2,000 | 1.9 | <0.002 |
| 9. Chlorobenzene | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 6,000 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 130,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 | <0.01 |
| 38. Methylene chloride | <10,000 | 910 | 5,900 | <2.0 | <0.01 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 7,800 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <2,000 | 2,300 | 41,000 | 3.7 | <0.002 |
| 45. 1,1,1-Trichloroethane | 45,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 2,500 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2 | <0.01 |
| **SEMIVOLATILES** | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 340 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.0035 |

* Only one sample of this waste type was taken.  The results are repeated in each sample set.

3-67

Table 3-11 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #5 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | <0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 90 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.0043 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 19 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 87 | <100 | <500 | 0.022 | <0.01 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.01 |
| 113. Hexachloroethane | 113 | <100 | <500 | 0.018 | <0.01 |
| 121. Naphthalene | 371 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 63 | <100 | 1,000 | 0.020 | <0.01 |
| 141. Phenanthrene | 19 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 73 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 72 | <50 | 19,000 | 1.240 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.010 |

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-11 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #5 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| METALS | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.35 |
| 155. Arsenic | <0.2 | 94 | 7.4 | <0.002 | 0.027 |
| 156. Barium | <0.9 | 1.3 | <19 | 1.670 | 0.600 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | 0.002 |
| 158. Cadmium | 0.36 | <0.3 | <33 | <0.003 | 0.12 |
| 159. Chromium | 3.2 | 40 | 23.7 | <0.009 | 0.14 |
| 160. Copper | 2.1 | 165 | 107 | 0.027 | 1.03 |
| 161. Lead | 2.5 | 27 | <7.3 | 0.0064 | 0.48 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.001 |
| 163. Nickel | 4.8 | 8.8 | 6.2 | 0.037 | 0.067 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | 0.090 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.02 | 0.160 |
| 168. Zinc | 4.7 | 4,170 | 6810 | 0.071 | 11.1 |
| INORGANICS | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 10 | <0.01 |
| 170. Fluoride | <5.0 | 31 | 15 | 950 | 12.0 |
| 171. Sulfide | NA | 830 | 16,000 | 17.0 | <1.0 |
| PCBs | | | | | |
| 206. Aroclor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken.  The results are repeated in each sample set.

Table 3-11 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #5 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature ($^O$F)$^+$ | * | 2400 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)$^+$ | * | PCB Blend Feed Rate: 37.5 Mercaptan-Contaminated Waste Feed Rate: 0.18 |
| Excess Oxygen Concentration (%)$^+$ | | 6.8 |
| Carbon Monoxide Concentration (ppm volume) | | NR |

NR Not Recorded.

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 3-12

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #6

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| VOLATILES | | | | | |
| 4. Benzene | <2,000 | 2,000 | <2,000 | 17.0 | <0.002 |
| 7. Carbon tetrachloride | 4,000 | <8 | <2,000 | 1.9 | <0.002 |
| 9. Chlorobenzene | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 14. Chloroform | 5,600 | <8 | <2,000 | <0.4 | <0.002 |
| 20. Trans-1,4-dichloro-2-butene | <10,000 | <40 | <10,000 | <2.0 | <0.01 |
| 21. Dichlorodifluoromethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 22. 1,1-Dichloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 23. 1,2-Dichloroethane | 98,000 | <8 | <2,000 | <0.4 | <0.002 |
| 34. Methyl ethyl ketone | <10,000 | 940 | <10,000 | 3.5 | <0.01 |
| 38. Methylene chloride | <10,000 | 910 | 5,900 | <2.0 | <0.01 |
| 41. 1,1,2,2-Tetrachloroethane | <2,000 | <8 | <2,000 | <0.4 | <0.002 |
| 42. Tetrachloroethene | 6,900 | 490 | <2,000 | <0.4 | <0.002 |
| 43. Toluene | <2,000 | 2,300 | 41,000 | 3.7 | <0.002 |
| 45. 1,1,1-Trichloroethane | 44,000 | 130 | <2,000 | 2.3 | <0.002 |
| 47. Trichloroethene | 2,500 | 360 | 3,600 | <0.4 | <0.002 |
| 215-217. Xylene (total) | <2,000 | 3,400 | 36,000 | 4.4 | <0.002 |
| 222. Acetone | <10,000 | 1,200 | <10,000 | <2 | <0.01 |
| 226. Ethyl benzene | <2,000 | 2,200 | 16,000 | 4.1 | <0.002 |
| 229. Methyl isobutyl ketone | <10,000 | 1,100 | <10,000 | <2 | <0.01 |
| SEMIVOLATILES | | | | | |
| 51. Acenaphthalene | <10 | 150 | 120 | <0.002 | <0.002 |
| 52. Acenaphthene | <10 | <20 | 480 | <0.002 | <0.002 |
| 56. Aniline | <25 | <50 | <250 | 1.22 | <0.005 |
| 57. Anthracene | <10 | 110 | 400 | <0.002 | <0.002 |
| 65. Benzo(k)fluoranthene | <10 | 67 | <100 | <0.002 | <0.002 |
| 68. Bis(2-chloroethyl)ether | 330 | <20 | <100 | <0.002 | <0.002 |
| 70. Bis(2-ethylhexyl)phthalate | <10 | 40 | <100 | 0.079 | <0.002 |

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-12 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #6 (Continued)

| Detected BDAT List Organic Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| SEMIVOLATILES (Continued) | | | | | |
| 80. Chrysene | SNA | 28 | <100 | <0.002 | <0.002 |
| 81. ortho-Cresol | <10 | <20 | <100 | <0.002 | <0.002 |
| 87. o-Dichlorobenzene | <10 | 250 | 1,060 | 2.55 | <0.002 |
| 88. p-Dichlorobenzene | 90 | 32 | 460 | 0.260 | <0.002 |
| 90. 2,4-Dichlorophenol | <25 | <50 | <250 | 0.420 | <0.005 |
| 91. 2,6-Dichlorophenol | <25 | <50 | 500 | 0.430 | <0.005 |
| 98. Di-n-butyl phthalate | <10 | 31 | 120 | 0.012 | 0.0025 |
| 104. Di-n-octyl phthalate | <10 | <20 | 430 | <0.002 | <0.002 |
| 108. Fluoranthene | <10 | 120 | 300 | <0.002 | <0.002 |
| 109. Fluorene | 22 | 53 | 340 | <0.002 | <0.002 |
| 110. Hexachlorobenzene | 66 | <100 | <500 | 0.022 | <0.01 |
| 111. Hexachlorobutadiene | <50 | 210 | <500 | 0.079 | <0.01 |
| 113. Hexachloroethane | 88 | <100 | <500 | 0.018 | <0.01 |
| 121. Naphthalene | 390 | <20 | 400 | 0.133 | <0.002 |
| 122. 1,4-Naphthoquinone | <10 | <20 | <100 | 0.078 | <0.002 |
| 126. Nitrobenzene | <25 | 3,400 | 8,200 | 0.027 | <0.005 |
| 136. Pentachlorobenzene | 65 | <100 | 1,000 | 0.020 | <0.01 |
| 141. Phenanthrene | 17 | 240 | 950 | <0.002 | <0.002 |
| 142. Phenol | <10 | 78 | 1,000 | 4.56 | <0.002 |
| 145. Pyrene | <10 | 200 | 260 | <0.002 | <0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 86 | <50 | 1,400 | 0.008 | <0.005 |
| 150. 1,2,4-Trichlorobenzene | 79 | <50 | 19,000 | 1.24 | <0.005 |
| 152. 2,4,6-Trichlorophenol | <50 | <100 | <500 | 0.037 | <0.01 |

SNA A standard is not available; the compound was searched using an NBS Library data-base of 42,000 compounds. The compound was not detected.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-12 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - AFTERBURNER

SAMPLE SET #6 (Continued)

| Detected BDAT List Metal, Inorganic and PCB Constituents | Untreated Waste Concentration | | | | Treated Waste |
|---|---|---|---|---|---|
| | K019 mg/kg (ppm) | RCRA Blend* mg/kg (ppm) | PCB Blend* mg/kg (ppm) | Mercaptan-Contaminated Waste* mg/L (ppm) | Scrubber Water mg/L (ppm) |
| METALS | | | | | |
| 154. Antimony | <6.0 | 24 | <41 | <0.06 | 0.32 |
| 155. Arsenic | <0.2 | 94 | 7.4 | <0.02 | 0.033 |
| 156. Barium | <0.9 | 1.3 | <19 | 1.670 | 0.57 |
| 157. Beryllium | <0.1 | <0.1 | NA | <0.001 | <0.001 |
| 158. Cadmium | 0.62 | <0.3 | <33 | 0.003 | 0.11 |
| 159. Chromium | 5.3 | 40 | 23.7 | <0.009 | 0.13 |
| 160. Copper | 3.6 | 165 | 107 | 0.027 | 0.87 |
| 161. Lead | 3.5 | 27 | <7.3 | 0.0064 | 0.4 |
| 162. Mercury | <0.05 | <0.05 | <5.5 | <0.001 | 0.001 |
| 163. Nickel | 6.0 | 8.8 | 6.2 | 0.037 | 0.061 |
| 165. Silver | <0.9 | <0.9 | <18 | 0.018 | 0.092 |
| 167. Vanadium | <2.0 | 2.2 | <2.6 | <0.02 | 0.16 |
| 168. Zinc | 8.4 | 4,170 | 6810 | 0.071 | 10.4 |
| INORGANICS | | | | | |
| 169. Total Cyanide | <0.5 | 0.9 | <0.5 | 0.010 | <0.01 |
| 170. Fluoride | <5.0 | 31 | 15 | 0.950 | 12.0 |
| 171. Sulfide | NA | 830 | 16,000 | 17.0 | <1 |
| PCBs | | | | | |
| 206. Aroclor 1260 | NA | NA | 33,500 | NA | NA |

NA Not Analyzed.

* Only one sample of this waste type was taken. The results are repeated in each sample set.

Table 3-12 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K019
PLANT A - ROTARY KILN INCINERATOR

SAMPLE SET #6 (Continued)

| DESIGN AND OPERATING PARAMETERS | DESIGN | OPERATING VALUE++ |
|---|---|---|
| Afterburner Temperature ($^O$F)$^+$ | * | 2350 |
| Residence Time (sec) | * | 2 |
| Waste Feed Rate (MMBTU/hr)$^+$ | * | PCB Blend Feed Rate: 37.5 Mercaptan-Contaminated Waste Feed Rate: 0.18 |
| Excess Oxygen Concentration (%)$^+$ | | 7.0 |
| Carbon Monoxide Concentration (ppm volume) | | NR |

NR Not Recorded.

+ Strip charts for this parameter are included in Appendix C.
++ See Tables 3-1 through 3-6 for K019 and RCRA Blend feed rates.

*This information has been claimed as RCRA Confidential Business Information. The
information is available in the confidential portion of the Administrative Record for
this rulemaking.

4.0     IDENTIFICATION OF BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY

This section presents the rationale behind the determination of rotary kiln incineration as the best demonstrated and available technology (BDAT) for the chlorinated waste group (K016, K018, K019, K020, and K030).

In Section 3.0 of this document, the Agency identified two demonstrated and available technologies to be considered for BDAT for the chlorinated waste group (K016, K018, K019, K020, and K030). The two technologies are: rotary kiln incineration and liquid injection incineration.

As described in Section 1.0, BDAT for treatment of these wastes is identified based on treatment performance data available to the Agency. (All performance data available to the Agency are discussed in Section 3.0.) Prior to being used to establish treatment standards, performance data are screened to determine whether they represent operation of a well-designed and operated system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data, and whether the appropriate measure of performance was used to assess the performance of the particular treatment technology, i.e., total constituent concentration in the case of incineration. All remaining data are then adjusted based on recovery data in order to take into account analytical interferences associated with the chemical make-up of the samples. Finally, treatment performance data from each technology are compared (technology to technology), to determine whether any technology performs better than the others.

## 4.1 Review of Performance Data

The available treatment performance data presented in Section 3.0 were reviewed and assessed to determine whether they represent operation of a well-designed and operated system, whether sufficient quality assurance/quality control measures were employed to ensure the accuracy of the data, and whether the appropriate measure of performance was used to assess the performance of the treatment technology.

The treatment performance data and the design and operating data collected during the test on the rotary kiln incineration of K019 at plant A were reviewed. The appropriate measure of performance (total constituent concentration) was used to assess the rotary kiln incineration system. Additionally, the Agency had no reason to believe that the treatment system at plant A was not well-designed and well-operated or that insufficient analytical quality assurance/quality control measures were employed. Therefore, these data were considered in the determination of BDAT.

As discussed in Section 3.0, treatment performance data are not available for liquid injection incineration for the chlorinated waste group (K016, K018, K019, K020, and K030). Therefore, in the absence of treatment performance data for these wastes or wastes judged to be similar, liquid injection incineration was considered and ultimately rejected as BDAT for the chlorinated waste group (K016, K018, K019, K020, and K030). However, the

Agency believes that a well designed and operated liquid injection incineration system will meet the BDAT treatment standards established for this waste group.

## 4.2    Accuracy Correction of Performance Data

Following the review of all available treatment performance data, the remaining treatment performance data for the demonstrated and available technology (rotary kiln incineration) were adjusted in order to take into account analytical interferences associated with the chemical make-up of the samples. Generally, performance data were corrected for accuracy as follows: (1) a matrix spike recovery was determined, as explained below, for each BDAT List constituent detected in the untreated or treated waste; (2) an accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (in percent) for that constituent; and (3) treatment performance data for each BDAT List constituent detected in the untreated or treated waste were corrected by multiplying the reported concentration of the constituent by the corresponding accuracy correction factor.

Matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then re-analyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking minus the initial concentration of the constituent in the sample, and the result divided by the known amount of constituent added.

4-3

4.2.1    Nonwastewater

Matrix spike recoveries used in adjustment of the treatment perfor-
mance data for the kiln ash residue are presented in Table D-4 of Appendix D
of this background document. Duplicate matrix spikes were performed for some
BDAT List volatile and semivolatile constituents in kiln ash. If duplicate
matrix spikes were performed for an organic constituent, the matrix spike
recovery used for that constituent was the lower of the two values from the
first matrix spike and the duplicate spike.

Where a matrix spike was not performed for an organic constituent,
the matrix spike recovery for that constituent was derived from the average
matrix spike recoveries of the appropriate group of constituents (volatile or
semivolatile constituents) for which recovery data were available. In these
cases, the matrix spike recoveries for all volatiles or semivolatiles from the
first matrix spike were averaged. Similarly, an average matrix spike recovery
was calculated for the duplicate matrix spike recoveries. The lower of the
two average matrix spike recoveries of the volatile or semivolatile group was
used for any volatile or semivolatile constituent for which no matrix spike
was performed. For example, no matrix spike was performed for di-n-butyl
phthalate, a base/neutral fraction semivolatile, in rotary kiln incinerator
ash; however, the treatment performance data for this constituent were
adjusted for accuracy using a matrix spike recovery of 103 percent. This
recovery was developed by averaging the matrix spike recoveries calculated for
all base/neutral fraction semivolatiles in the first matrix spike (104%) and

the duplicate spike (103%). The lower average matrix spike recovery of 103% was selected to subsequently calculate the accuracy correction factor and the corrected treatment concentration for di-n-butyl phthalate.

The accuracy correction factors for rotary kiln ash data are presented in Table D-6 of Appendix D of this document. The corrected treatment concentrations for the BDAT List organic constituents detected in either the untreated K019 or rotary kiln ash are presented in Table 4-1 for kiln ash residue.

## 4.2.2    Wastewater

The method used for accuracy correction of the wastewater (scrubber water) data was the same as that described above for nonwastewaters, except that the specific matrix spike recovery values used in this proposed rule for constituents for which matrix spike recovery data are not available differed from those used in nonwastewaters.

The method for determination of accuracy correction factors used in this proposed rule is discussed in subsection 4.2.2(a). Also presented below (Section 4.2.2(b)) is the adjustment of treatment concentrations using accuracy correction factors determined to be consistent with the method used at proposal for nonwastewaters. EPA will consider this method for the final rule.

(a) Method used in proposed rule. Presented in this section is the method used to determine accuracy correction factors used and the subsequent adjustment of the wastewater (scrubber water) treatment performance data performed for the proposed rule. Matrix spike recoveries used to calculate accuracy correction factors for adjustment of the treatment performance data are presented in Table D-5 of Appendix D of this background document. As shown in Table D-5, duplicate matrix spikes were performed for an organic constituent, the matrix spike recovery used for that constituent was the lower of the two values from the first matrix spike and the duplicate spike.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the lowest matrix spike recovery of the appropriate group of constituents (volatile or semivolatile) for which recovery data were available. For example, no matrix spike was performed for naphthalene, a base/neutral fraction semivolatile, in scrubber water; however, the treatment performance data for this constituent were adjusted for accuracy using a matrix spike recovery of 60 percent. This recovery (60%) from 1,2,4-trichlorobenzene was the lowest matrix spike recovery for all base/neutral fraction semivolatiles in the first spike and the duplicate spike. The lowest matrix spike recovery of 60% was used to subsequently calculate the accuracy correction factor and the corrected treatment concentration for naphthalene.

The accuracy correction factors for wastewater (scrubber water) data are presented in Table D-6 of Appendix D of this document. The corrected

4-6

treatment concentrations for the BDAT List organic constituent detected in either the untreated K019 or scrubber water are presented in Table 4-2.

b)  Method to be considered for the final rule.  Presented in this section is an alternative method for determination of accuracy correction factors and the subsequent adjustment of the wastewater (scrubber water) treatment performance data to be considered for the final rule.  Matrix spike recoveries used to calculate accuracy correction factors for adjustment of the treatment performance data are presented in Table D-7 of Appendix D.  As shown in Table D-7, if duplicate matrix spikes were performed for an organic constituent, the matrix spike recovery used for that constituent was the lower of the two values from the first matrix spike and the duplicate spike.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the average matrix recoveries of the appropriate group of constituents (volatile or semivolatile constituents) for which recovery data were available.  In these cases, the matrix spike recoveries for all volatiles or semivolatiles from the first matrix spike were averaged.  Similarly, an average matrix spike recovery was calculated for the duplicate matrix spike recoveries.  The lower of the two average matrix spike recoveries of the volatile or semivolatile group was used for any volatile or semivolatile constituent for which no matrix spike was performed.  For example, no matrix spike was performed for 1,1,2-tri-chloroethane, a volatile, in scrubber water; however, the treatment performance data for this constituent were adjusted for accuracy using a

matrix spike recovery of 78 percent. This recovery was determined by averaging the matrix spike recoveries calculated for all volatiles in the first matrix spike (83%) and the duplicate spike (78%). The lower average matrix spike recovery of 78% was selected to subsequently calculate the accuracy correction factor and the corrected treatment concentration for 1,1,2-trichloroethane.

The accuracy correction factors for wastewater (scrubber water) data calculated using this method are presented in Table D-6 of Appendix D of this document. The corrected treatment concentrations for each BDAT List organic constituent detected in either the untreated K019 or scrubber water are presented in Table 4-3.

4.3     Statistical Comparison of Performance Data

In cases where the Agency has treatment data from more than one technology, EPA uses the statistical method known as the analysis of variance, ANOVA (discussed in Section 1.0), to determine if one technology performs significantly better than the rest. In this case the Agency has treatment data only for rotary kiln incineration of K019 at plant A; therefore, an ANOVA comparison is not applicable and rotary kiln incineration is determined to be BDAT for the nonwastewater forms of K019.

## 4.4 BDAT for K016, K018, K019, K020 and K030

The best demonstrated and available technology for K019 has been determined to be rotary kiln incineration. As discussed in Section 2.0, EPA has determined that the chlorinated waste group, K016, K018, K019, K020 and K030, represents a single waste treatability group. Therefore, since rotary kiln incineration has been determined to be BDAT for K019, this technology is also BDAT for K016, K018, K020 and K030.

Table 4-1

TREATMENT CONCENTRATIONS FOR KO19 KILN ASH RESIDUE CORRECTED FOR ACCURACY*

| | Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 (ppm) | 2 (ppm) | 3 (ppm) | 4 (ppm) | 5 (ppm) | 6 (ppm) |
| 7. | Carbon tetrachloride | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 9. | Chlorobenzene | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 |
| 14. | Chloroform | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 22. | 1,1-Dichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 23. | 1,2-Dichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 42. | Tetrachloroethene | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 45. | 1,1,1-Trichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 47. | Trichloroethene | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 |
| 68. | Bis(2-chloroethyl)ether | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 70. | Bis(2-ethylhexyl)phthalate | 1.94 | 1.94 | 1.94 | 11.7 | 1.94 | 1.94 |
| 98. | Di-n-butyl phthalate | 1.94 | 1.94 | 1.94 | 223 | 1.94 | 1.94 |
| 109. | Fluorene | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 110. | Hexachlorobenzene | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 113. | Hexachloroethane | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 121. | Naphthalene | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 136. | Pentachlorobenzene | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 141. | Phenanthrene | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 148. | 1,2,4,5-Tetrachlorobenzene | 4.85 | 4.85 | 4.85 | 4.85 | 4.85 | 4.85 |
| 150. | 1,2,4-Trichlorobenzene | 6.67 | 6.67 | 6.67 | 6.67 | 6.67 | 6.67 |

*This table presents corrected treatment concentrations for the BDAT List organic constituents detected in either the untreated KO19 or rotary kiln ash from plant A. Calculations are shown in Appendix D.

Table 4-2

TREATMENT CONCENTRATIONS FOR SCRUBBER WATER CORRECTED FOR ACCURACY*
(CALCULATED FOR PROPOSAL)**

| | | Sample Set | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| | Constituent | (ppm) | (ppm) | (ppm) | (ppm) | (ppm) | (ppm) |
| 7. | Carbon tetrachloride | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 9. | Chlorobenzene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 14. | Chloroform | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 21. | Dichlorodifluoromethane | 0.005 | 0.005 | 0.009 | 0.032 | 0.005 | 0.005 |
| 22. | 1,1-Dichloroethane | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 23. | 1,2-Dichloroethane | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 42. | Tetrachloroethene | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 43. | Toluene | 0.005 | 0.007 | 0.007 | 0.0011 | 0.005 | 0.005 |
| 45. | 1,1,1-Trichloroethane | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 47. | Trichloroethene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 68. | Bis(2-chloroethyl)ether | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 88. | p-Dichlorobenzene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 98. | Di-n-butyl phthalate | 0.003 | 0.010 | 0.008 | 0.007 | 0.005 | 0.005 |
| 109. | Fluorene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 110. | Hexachlorobenzene | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 113. | Hexachloroethane | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 121. | Naphthalene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 136. | Pentachlorobenzene | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 141. | Phenanthrene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 148. | 1,2,4,5-Tetrachlorobenzene | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| 150. | 1,2,4-Trichlorobenzene | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

*This table presents corrected treatment concentrations for the BDAT List
organic constituents detected in either the untreated K019 or scrubber water
from plant A. Calculations are shown in Appendix D.

**The adjusted treatment concentration values were obtained using the method
for determination of accuracy correction factors for wastewater
(scrubber water) used for the proposed rule. Proposed treatment standards
are based on these adjusted concentrations.

Table 4-3

TREATMENT CONCENTRATIONS FOR SCRUBBER WATER CORRECTED FOR ACCURACY*
(TO BE CONSIDERED FOR THE FINAL RULE)**

| | Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 (ppm) | 2 (ppm) | 3 (ppm) | 4 (ppm) | 5 (ppm) | 6 (ppm) |
| 7. | Carbon tetrachloride | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 9. | Chlorobenzene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 14. | Chloroform | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 21. | Dichlorodifluoromethane | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 22. | 1,1-Dichloroethane | 0.003 | 0.003 | 0.006 | 0.018 | 0.003 | 0.003 |
| 23. | 1,2-Dichloroethane | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 42. | Tetrachloroethene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 43. | Toluene | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| 45. | 1,1,1-Trichloroethane | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| 47. | Trichloroethene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 68. | Bis(2-chloroethyl)ether | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 88. | p-Dichlorobenzene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 98. | Di-n-butyl phthalate | 0.002 | 0.008 | 0.005 | 0.005 | 0.003 | 0.003 |
| 109. | Fluorene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 110. | Hexachlorobenzene | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 113. | Hexachloroethane | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 121. | Naphthalene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 136. | Pentachlorobenzene | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 141. | Phenanthrene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 148. | 1,2,4,5-Tetrachlorobenzene | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| 150. | 1,2,4-Trichlorobenzene | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

*This table presents corrected treatment concentrations for the BDAT List organic constituents detected in either the untreated K019 or scrubber water from plant A. Calculations are shown in Appendix D.

**These adjusted treatment concentrations were obtained using the alternative method for determination of accuracy correction factors to be considered for the final rule. These adjusted treatment concentrations were used to calculate wastewater treatment standards which will be considered for the final rule.

5.0     SELECTION OF REGULATED CONSTITUENTS

This section presents the methodology and rationale for selection of the constituents that are being proposed for regulation in KO16, KO18, KO19, KO20, and KO30.

The Agency initially considers for regulation all constituents on the BDAT List (see Table 1-1, Section 1.0). Table 5-1 presents a summary of the BDAT List constituents that were detected in KO16, KO18, KO19, KO20, and KO30. All BDAT List constituents that were detected in the wastes were further considered for regulation in that waste, unless a constituent was deleted from consideration for one of the following reasons: (1) the constituent was not present at treatable levels in the untreated wastes; (2) treatment performance data for the constituent did not show effective treatment; or (3) the constituent was detected in an untreated waste at treatable levels but treatment performance data demonstrating effective treatment by BDAT were unavailable for that constituent in the waste or for a waste judged to be similar. Table 5-2 presents constituents from the BDAT constituent list that were considered for regulation following deletion of certain constituents for the three reasons described above.

Not all BDAT List constituents considered for regulation and shown on Table 5-2 were selected for regulation. Two methods are presented for selection of constituents for regulation in KO16, KO18, KO19, KO20, and KO30: the method used for wastewaters in this proposed rule and the method used for

nonwastewaters in this proposed rule and which the Agency will consider for selection of regulated constituents in both wastewaters and nonwastewaters for the final rule.

The constituents proposed for regulation in wastewater were selected by considering the concentrations of BDAT List constituents present in the untreated K016, K018, K019, K020, and K030. This selection method is discussed in more detail in Section 5.3.2(a).

The Agency selected constituents for regulation in nonwastewater for the proposed rule after consideration of the concentration of the constituent in the untreated waste, the relative difficulty associated with achievement of effective treatment of the constituent by BDAT, and the level of control of the constituent that can be expected through treatment required to comply with treatment standards established for other constituents in the waste. This selection method is discussed in more detail in Sections 5.1, 5.2, and 5.3. Constituents proposed for regulation in nonwastewaters are presented in Section 5.3.1. Constituents selected for regulation in wastewater based on this methodology are presented in Section 5.3.2(b).

## 5.1     BDAT List Constituents Detected in the Waste

BDAT List constituents that were detected in untreated K016, K018, K019, K020, and K030 were considered for regulation. In addition to the constituents detected in the untreated waste, those constituents that were

detected in the treatment residuals were also considered for regulation, even if they were not detected in the untreated waste. These constituents are labelled ND** in Table 5-1. For each of these constituents, EPA determined (1) whether the constituent was introduced to the treatment system in another waste treated at the same time as the waste of concern; (2) whether analytical difficulties may have interfered with detection of the constituent in the untreated waste; and (3) whether the constituent may have been formed as a result of treatment of the waste of concern. Specifically, for treatment by incineration, EPA evaluated the likelihood that the constituent is a product of incomplete combustion of the waste of concern.

A BDAT List constituent was not considered for regulation if: (1) the constituent was not detected in the untreated waste; (2) the constituent was not analyzed in the untreated waste; or (3) detection limits or analytical results were not obtained for the constituent due to analytical or accuracy problems. The constituents that were not considered for regulation for these reasons are identified in Table 5-1; each reason is explained in more detail below.

Constituents That Were Not Detected in the Untreated Waste. Constituents that were not detected in the untreated waste (labelled ND or ND* in Table 5-1) were not considered for regulation. Analytical detection limits were, in most cases, practical quantification limits. In some cases, where data were submitted to the Agency by outside sources, the nature of the detection limits and whether or not the waste was analyzed for a constituent

are unknown (labelled ND* in Table 5-1). Since detection limits vary depend-
ing upon the nature of the waste matrix being analyzed, the detection limits
determined in the characterization of these wastes are included in Appendix F.

Constituents That Were Not Analyzed. Some constituents on the BDAT
List were not considered for regulation because they were not analyzed in the
untreated wastes (labelled NA, NA*, or NA** in Table 5-1). Some constituents
were not analyzed in the untreated wastes based on the judgment that it is
extremely unlikely that the constituent would be present in the wastes (NA**).
Other constituents were not analyzed in the untreated waste because they were
not on the BDAT List of constituents at the time of analysis (NA*). In cases
where data were submitted to the Agency by outside sources, it may not be
known if and/or why constituents were not analyzed (NA).

Constituents For Which Analytical Results Were Not Obtained Due to
Analytical or Accuracy Problems. Some constituents on the BDAT List were not
considered for regulation because detection limits or analytical results were
not obtained due to analytical or accuracy problems (labelled A in Table 5-1).
The analytical and accuracy problems include:  (1) laboratory QA/QC analyses
indicated inadequate recoveries and, therefore, the accuracy of the analysis
for the constituent could not be ensured; (2) a standard was not available for
the constituent and, therefore, system calibration could not be performed for
the constituent; and (3) colorimetric interferences occurred during analysis
for the constituent and, therefore, accurate analyses could not be performed.

## 5.2    Constituents Detected in Untreated Waste But Not Considered for Regulation

BDAT List constituents that were detected in the untreated K016, K018, K019, K020, and K030 wastes were not considered for regulation if (1) available treatment performance data for the constituent did not show effective treatment by BDAT; (2) treatment performance data were not available for the constituent; or (3) the constituent was not present at treatable levels in the waste.

BDAT List metal constituents were not considered for regulation in K016, K018, K019, K020, and K030 because these constituents were not detected at treatable concentrations in neither the untreated K019 waste nor the K019 treatment residuals (incinerator ash and scrubber water). Data were not available for metals analyses in K016, K018, K020, and K030. However, due to the similarity between these wastes and K019, metals would also not be expected to be present at treatable concentrations. Furthermore, incineration, the technology for which treatment performance data were collected for K019 waste, does not provide substantial treatment for metals.

Sulfide was not considered for regulation for K019 nonwastewater because the technology determined to be BDAT for K019 (rotary kiln incineration) does not provide effective treatment for this constituent. Moreover, the Agency is unaware of any demonstrated technology for treatment of sulfide in K019.

BDAT List constituents that were further considered for regulation following the deletion of BDAT List metals are listed on Table 5-2.

## 5.3    Constituents Selected for Regulation

BDAT List constituents selected for regulation in K016, K018, K019, K020, and K030 are presented in Table 5-3. The selection of regulated constituents in nonwastewaters is discussed in Section 5.3.1 and for wastewaters in Section 5.3.2.

### 5.3.1    Selection of Regulated Constituents in Nonwastewater

Regulated organic and inorganic constituents in nonwastewater were selected from those BDAT List organic and inorganic constituents detected in the untreated wastes that were effectively treated by rotary kiln incineration.

As explained in Section 1.0, the Agency is not regulating all of the constituents considered for regulation (Table 5-2) to reduce the analytical cost burdens on the treater and to facilitate implementation of the compliance and enforcement program. Table 5-3 presents the constituents selected for regulation after consideration of: (1) constituent concentration levels in the untreated waste; (2) whether the constituents are adequately controlled by the regulation of another constituent; and (3) the relative difficulty associated with achieving effective treatment of the constituent by BDAT.

Determination of adequate control for organic constituents was based on an evaluation of the characteristics of the constituents that would affect performance of rotary kiln incineration relative to the kiln ash residual, specifically, the boiling point of the constituents. In general, a constituent is believed to be controlled by regulation of another constituent that has a higher boiling point. Boiling points for all BDAT List constituents considered for regulation are tabulated in Appendix E.

The constituents selected for regulation and the constituents controlled by regulating other constituents are discussed below for each waste code.

### K016

All constituents considered for regulation in K016 nonwastewater were selected for regulation. The constituents selected for regulation are tetrachloroethane, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, and hexachloroethane.

### K018

Chloroethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,1,1-trichloroethane, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, and pentachloroethane were selected for regulation in K018 nonwastewater. Chloromethane and 1,1,2-trichloroethane were detected in untreated K018 and were considered for regulation, but were not selected because they were found at

lower concentrations in the untreated waste and they are believed to be
adequately controlled by incineration of other constituents that have been
selected for regulation. This decision was based on a comparison of boiling
points of those constituents considered for regulation. EPA believes that
chloromethane (bp $-24^{\circ}C$) will be adequately controlled by regulation of
chloroethane (bp $12^{\circ}C$), 1,1-dichloroethane (bp $57^{\circ}C$), and other regulated
constituents with boiling points higher than $-24^{\circ}C$. 1,1,2-Trichloroethane (bp
$113^{\circ}C$) will be adequately controlled by regulation of pentachloroethane (bp
$161^{\circ}C$), hexachloroethane (bp $187^{\circ}C$), and other regulated constituents with
boiling points higher than $113^{\circ}C$.


### K019


Chlorobenzene, chloroform, 1,2-dichloroethane, tetrachloroethene,
1,1,1-trichloroethane, bis(2-chloroethyl)ether, hexachloroethane, naphthalene,
phenanthrene, and 1,2,4-trichlorobenzene were selected for regulation in K019
nonwastewater. Carbon tetrachloride, 1,1-dichloroethane, 1,1,2,2-tetra-
chloroethane, trichloroethene, 1,1,2-trichloroethane, p-dichlorobenzene,
fluorene, hexachlorobutadiene, hexachlorobenzene, pentachlorobenzene, and
1,2,4,5-tetrachlorobenzene were detected in untreated K019 and were considered
for regulation, but were not selected because these constituents were found at
lower concentrations in the untreated waste and they are believed to be
adequately controlled by incineration of other constituents which have been
selected for regulation. This decision was based on a comparison of the
boiling points of those constituents considered for regulation. EPA believes
that carbon tetrachloride (bp $77^{\circ}C$) will be adequately controlled by regu-

lation of chlorobenzene (bp 131°C), 1,2-dichloroethane (bp 83°C), and other

regulated constituents with boiling points higher than 77°C. 1,1-Dichloro-

ethane (bp 57°C) will be adequately controlled by regulation of chlorobenzene

(bp 131°C), chloroform (bp 61°C), and other regulated constituents with

boiling points higher than 57°C. Trichloroethene (bp 87°) will be adequately

controlled by regulation of chlorobenzene (bp 131°C, tetrachloroethene (bp

121°C), and other regulated constituents with boiling points higher than 87°C.

p-Dichlorobenzene (bp 174°C) will be adequately controlled by regulation of

bis(2-chloroethyl)ether (bp 178°C), hexachloroethane (bp 187°C), and other

regulated constituents with boiling points higher than 174°C. 1,1,2-Tri-

chloroethane (bp 113°C) and 1,1,2,2-tetrachloroethane (bp 147°C) will be

adequately controlled by regulation of bis(2-chloroethyl)ether (bp 178°C), and

other regulated constituents with boiling points higher than 147°C. Fluorene

(bp 295°C), hexachlorobutadiene (bp 215°C), hexachlorobenzene (bp 324°C),

pentachlorobenzene (bp 276°C), and 1,2,4,5-trichlorobenzene (bp 246°C) will be

adequately controlled by regulation of phenanthrene (bp 340°C).


Bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were not

detected in untreated K019 but were detected in kiln ash residue from rotary

kiln incineration of K019 at plant A (sampled by EPA). These constituents

were considered for regulation but were not selected because they were found

at treatable concentrations in another waste (RCRA Blend) that was incinerated

with K019 during the sampling episode at plant A.

KO20

1,2-Dichloroethane, 1,1,2,2-tetrachloroethane, and tetrachloroe-
thene, were selected for regulation in KO20 nonwastewater. 1,1,2-Trichloroe-
thane was considered for regulation, but was not selected because it was found
at a lower concentration in the untreated waste, and it is believed to be
adequately controlled by incineration of other constituents which have been
selected for regulation. This decision was based on a comparison of the
boiling points of those constituents considered for regulation. EPA believes
that 1,1,2-trichloroethane (bp 113°C) will be adequately controlled by regu-
lation of 1,1,2,2-tetrachloroethane (bp 147°C) and tetrachloroethene (bp
121°C).

KO30

Tetrachloroethene, hexachlorobutadiene, hexachloroethane, hexa-
chloropropene, pentachlorobenzene, pentachloroethane, 1,2,4,5-tetrachloro-
benzene, and 1,2,4-trichlorobenzene were selected for regulation in KO30
nonwastewater. o-Dichlorobenzene, p-dichlorobenzene, and hexachlorocylo-
pentadiene were detected in untreated KO30 and were considered for regulation
but were not selected because these constituents were found at lower concen-
trations in the untreated waste and they are believed to be adequately con-
trolled by incineration of other constituents which have been selected for
regulation. This decision was based on a comparison of the boiling points of
those constituents considered for regulation. EPA believes that o-dichloro-

benzene (bp 181°) and p-dichlorobenzene (bp 174°C) will be adequately controlled by regulation of hexachlorobutadiene (bp 215°C), hexachloroethane (bp 187°C), and other regulated constituents with boiling points higher than 181°C. Hexachlorocyclopentadiene (bp 234°C) will be adequately controlled by regulation of pentachlorobenzene (bp 276°C) and 1,2,4,5-tetrachlorobenzene (bp 246°C).

## 5.3.2    Selection of Regulated Constituents in Wastewaters

(a)  Method for Selection of Regulated Constituents used for Proposal.  The constituents proposed for regulation in wastewater were selected by considering the concentrations of BDAT List constituents preset in the untreated wastes K016, K018, K019, K020, and K030.  BDAT List constituents detected in the untreated wastes are identified in Table 5-1.  Waste characterization data showing the concentrations of BDAT List constituents in the wastes are presented in Section 2.0.  In general, the constituents selected for regulation were present at treatable concentrations in the wastes.  The constituents proposed for regulation are presented in Table 5-3 by waste code.

(b)  Alternative Method for Selection of Regulated Constituents to be Considered for the Final Rule.  This section presents regulated constituents for wastewater forms of K016, K018, K019, K020, and K030 which were selected based on the method proposed for nonwastewaters.  This selection method and the resulting list of constituents selected for regulation in wastewaters will be considered for the final rule.

Regulated organic constituents in wastewater were selected from the BDAT List organic constituents detected in the untreated wastes that showed treatment using rotary kiln incineration.

As explained in Section 1.0, not all of the constituents considered for regulation (Table 5-2) will be regulated by the Agency to reduce the analytical cost burdens on the treater and to facilitate implementation of the compliance and enforcement program. Table 5-4 presents the constituents selected for regulation after consideration of: (1) constituent concentration in the untreated waste; (2) whether the constituents are adequately controlled by the regulation of another constituent; and (3) the relative difficulty associated with achieving effective treatment of the constituent by BDAT.

The Agency's determination of adequate control for organic constituents is based on an evaluation of the characteristics of the constituents that would affect performance of incineration relative to the scrubber water residual, specifically, the estimated bond dissociation energies for the constituents. In general, a constituent is believed to be controlled by regulation of another constituent that has a higher bond dissociation energy. Estimated bond dissociation energies for all BDAT list constituents considered for regulation are tabulated in Appendix E.

The constituents selected for regulation and the constituents controlled by regulating other constituents are discussed below by waste code.

K016

All constituents considered for regulation in K016 wastewater were
selected for regulation.  The constituents selected for regulation are tetra-
chloroethene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopenta-
diene, and hexachloroethane.

K018

Chloroethane, chloromethane, 1,1-dichloroethane, 1,2-dichloroethane,
1,1,1-trichloroethane, hexachlorobenzene, hexachlorobutadiene, and penta-
chloroethane were selected for regulation in K018 wastewater.  Hexachloro-
ethane and 1,1,2-trichloroethane were considered for regulation but were not
selected because these constituents were found in lower concentrations in the
untreated waste, and they are believed to be adequately controlled by incin-
eration of other constituents which have been selected for regulation.  This
decision was based on a comparison of bond dissociation energies (BDE) of
those constituents considered for regulation.  EPA believes that hexachloro-
ethane (BDE 565 kcal/mole) will be adequately controlled by regulation of
pentachloroethane (BDE 585 kcal/mole), 1,1,1-trichloroethane (BDE 625
kcal/mole), and other regulated constituents with bond dissociation energies
greater than 565 kcal/mole.  1,1,2-Trichloroethane (BDE 625 kcal/mole), will
be adequately controlled by regulation of 1,1-dichloroethane (BDE 645
kcal/mole), 1,2-dichloroethane (BDE 645 kcal/mole), and other regulated
constituents with bond dissociation energies higher than 625 kcal/mole.

KO19

Chlorobenzene, chloroform, 1,2-dichloroethane, tetrachloroethene, 1,1,1-trichloroethane, bis(2-chloroethyl)ether, p-dichlorobenzene, fluorene, hexachloroethane, naphthalene, phenanthrene, 1,2,4,5-tetrachlorobenzene, and 1,2,4-trichlorobenzene were selected for regulation in KO19 wastewater. Carbon tetrachloride, 1,1-dichloroethane, trichloroethene, hexachloro- butadiene, hexachlorobenzene, and pentachlorobenzene were considered for regulation but were not selected because these constituents were found in lower concentrations in the untreated waste, and they are believed to be adequately controlled by incineration of other constituents which have been selected for regulation. 1,1,2-Trichloroethane and 1,1,2,2-tetrachloroethane were considered for regulation but were not selected for regulation because these constituents are believed to be adequately controlled by incineration of other constituents which have been selected for regulation. This decision was based on a comparison of bond dissociation energies (BDE) of those constitu- ents considered for regulation. EPA believes that carbon tetrachloride (BDE 312 kcal/mole), 1,1-dichloroethane (BDE 645 kcal/mole), trichloroethene (BDE 481 kcal/mole), 1,1,2-trichloroethane (BDE 625 kcal/mole), and 1,1,2,2-tetra- chloroethane (BDE 605 kcal/mole) will be adequately controlled by regulation of bis(2-chloroethyl) ether (BDE 1290 kcal/mole), chlorobenzene (BDE 1320 kcal/mole), and other regulated constituents with bond dissociation energies greater than 625 kcal/mole. Hexachlorobutadiene (BDE 853 kcal/mole), hexa- chlorobenzene (BDE 1310 kcal/mole), and pentachlorobenzene (BDE 1310 kcal/mole) will be adequately controlled by regulation of chlorobenzene (BDE

1320 kcal/mole), p-dichlorobenzene (BDE 1325 kcal/mole), and other regulated constituents with bond dissociation energies greater than 1310 kcal/mole.

Dichlorodifluoromethane, toluene, and di-n-butyl phthalate were not detected in untreated K019 waste but were detected in the scrubber water residual from rotary kiln incineration of K019 at plant A (sampled by EPA). These constituents were considered but not selected for regulation in K019 wastewater. Toluene and di-n-butyl phthalate were not selected for regulation because they were present at treatable concentrations in other wastes that were incinerated with K019 during the sampling episode at plant A. Dichloro-difluoromethane may have been formed in the kiln or afterburner at plant A since it was not detected in any of the wastes incinerated at plant A during the sampling episode. This constituent is not believed to have formed as a result of incineration of K019, since there is neither fluoride nor a source of fluorine in K019. Therefore, dichlorodifluoromethane was not selected for regulation.

### K020

1,2-Dichloroethane, 1,1,2,2-tetrachloroethane, and tetrachloroethene were selected for regulation in K020 wastewater. 1,1,2-trichloroethane was considered for regulation but was not selected for regulation because it was found at a lower concentration in the untreated waste, and it was believed to be adequately controlled by incineration of other regulated constituents which have been selected for regulation. This decision was based on a comparison of

bond dissociation energies (BDE) of those constituents considered for regulation. EPA believes that 1,1,2-trichloroethane (BDE 625 kcal/mole) will be adequately controlled by regulation of 1,2-dichloroethane (BDE 645 kcal/mole).

### K030

Tetrachloroethene, o-dichlorobenzene, p-dichlorobenzene, hexachlorobutadiene, hexachloroethane, pentachloroethane, 1,2,4,5-tetrachlorobenzene, and 1,2,4-trichlorobenzene were selected for regulation in K030 wastewater. Hexachlorocyclopentadiene, hexachloropropene, and pentachlorobenzene were considered for regulation but were not selected for regulation because these constituents were found at lower concentration in the untreated waste, and they are believed to be adequately controlled by incineration of other constituents which have been selected for regulation. This decision was based on a comparison of bond dissociation energies (BDE) of those constituents considered for regulation. EPA believes that hexachlorocyclopentadiene (BDE 1020 kcal/mole), hexachloropropene (BDE 710 kcal/mole), and pentachlorobenzene (BDE 1310 kcal/mole) will be adequately controlled by regulation of o-dichlorobenzene (BDE 1325 kcal/mole), p-dichlorobenzene (BDE 1325 kcal/mole), 1,2,4,5-tetrachlorobenzene (BDE 1320 kcal/mole), and 1,2,4-trichlorobenzene (BDE 1320 kcal/mole).

Table 5-1

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Volatiles | | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|---|
| 222. | Acetone | ND | ND | NA* | ND | ND |
| 1. | Acetonitrile | NA | NA | ND | NA | NA |
| 2. | Acrolein | NA | NA | ND | NA | NA |
| 3. | Acrylonitrile | NA | NA | ND | NA | NA |
| 4. | Benzene | ND | ND | ND | ND | ND |
| 5. | Bromodichloromethane | ND | ND | ND | ND | ND |
| 6. | Bromomethane | ND | ND | ND | ND | ND |
| 223. | n-Butyl alcohol | NA* | NA* | NA* | NA* | NA* |
| 7. | Carbon tetrachloride | ND | ND | D | ND | ND |
| 8. | Carbon disulfide | NA | NA | A | NA | NA |
| 9. | Chlorobenzene | ND | ND | D | ND | ND |
| 10. | 2-Chloro-1,3-butadiene | NA | NA | ND | NA | NA |
| 11. | Chlorodibromomethane | ND | ND | ND | ND | ND |
| 12. | Chloroethane | ND | D | ND | ND | ND |
| 13. | 2-Chloroethyl vinyl ether | ND | ND | A | ND | ND |
| 14. | Chloroform | ND | ND | D | ND | ND |
| 15. | Chloromethane | ND | D | ND | ND | ND |
| 16. | 3-Chloropropene | NA | NA | ND | NA | NA |
| 17. | 1,2-Dibromo-3-chloropropane | NA | NA | ND | NA | NA |
| 18. | 1,2-Dibromoethane | NA | NA | ND | NA | NA |
| 19. | Dibromomethane | NA | NA | ND | NA | NA |
| 20. | trans-1,4-Dichloro-2-butene | ND | ND | ND | ND | ND |
| 21. | Dichlorodifluoromethane | NA | NA | ND** | NA | NA |
| 22. | 1,1-Dichloroethane | ND | D | D | ND | ND |
| 23. | 1,2-Dichloroethane | ND | D | D | D | ND |
| 24. | 1,1-Dichloroethylene | ND | ND | ND | ND | ND |
| 25. | trans-1,2-Dichloroethene | ND | ND | ND | ND | ND |
| 26. | 1,2-Dichloropropane | ND | ND | ND | ND | ND |
| 27. | trans-1,3-Dichloropropene | ND | ND | ND | ND | ND |
| 28. | cis-1,3-Dichloropropene | ND | ND | ND | ND | ND |
| 29. | 1,4-Dioxane | NA | NA | A | NA | NA |
| 224. | 2-Ethoxyethanol | NA* | NA* | NA* | NA* | NA* |

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    not obtained due to analytical problems.
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NA - Believed that untreated waste was not analyzed for this constituent.
NA* - Untreated waste was not analyzed for this constituent because it was
    not on the BDAT List at the time of analysis.
ND - Constituent was not detected in the untreated waste.
ND** - Constituent was not detected in the untreated waste but was detected in
    the treated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Volatiles (Cont.) | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 225. Ethyl acetate | NA* | NA* | NA* | NA* | NA* |
| 226. Ethyl benzene | ND | ND | NA* | ND | ND |
| 30. Ethyl cyanide | NA | NA | ND | NA | NA |
| 227. Ethyl ether | NA* | NA* | NA* | NA* | NA* |
| 31. Ethyl methacrylate | NA | NA | ND | NA | NA |
| 214. Ethylene oxide | NA* | NA* | NA* | NA* | NA* |
| 32. Iodomethane | NA | NA | ND | NA | NA |
| 33. Isobutyl alcohol | NA | NA | ND | NA | NA |
| 228. Methanol | NA* | NA* | NA* | NA* | NA* |
| 34. Methyl ethyl ketone | NA | NA | ND | NA | NA |
| 229. Methyl isobutyl ketone | NA* | NA* | NA* | NA* | NA* |
| 35. Methyl methacrylate | NA | NA | ND | NA | NA |
| 37. Methacrylonitrile | NA | NA | ND | NA | NA |
| 38. Methylene chloride | ND | ND | ND | ND | ND |
| 230. 2-Nitropropane | NA* | NA* | NA* | NA* | NA* |
| 39. Pyridine | NA | NA | ND | NA | NA |
| 40. 1,1,1,2-Tetrachloroethane | ND | ND | ND | ND | ND |
| 41. 1,1,2,2-Tetrachloroethane | ND | ND | D | D | ND |
| 42. Tetrachloroethene | D | ND | D | D | D |
| 43. Toluene | ND | ND | ND** | ND | ND |
| 44. Tribromomethane | NA | NA | ND | NA | NA |
| 45. 1,1,1-Trichloroethane | ND | D | D | ND | ND |
| 46. 1,1,2-Trichloroethane | ND | D | D | D | ND |
| 47. Trichloroethene | ND | ND | D | ND | ND |
| 48. Trichloromonofluoromethane | NA | NA | ND | NA | NA |
| 49. 1,2,3-Trichloropropane | ND | ND | ND | ND | ND |
| 231. 1,1,2-Trichloro-1,2,2-trifluoroethane | NA* | NA* | NA* | NA* | NA* |
| 50. Vinyl chloride | ND | ND | ND | ND | ND |
| 215. 1,2-Xylene | ND | ND | ND | ND | ND |
| 216. 1,3-Xylene | ND | ND | ND | ND | ND |
| 217. 1,4-Xylene | ND | ND | ND | ND | ND |

A - Constituent was analyzed but a detection limit or analytical result was not obtained due to analytical problems.

D - Constituent was detected in the untreated waste.

NA - Believed that untreated waste was not analyzed for this constituent.

NA* - Untreated waste was not analyzed for this constituent because it was not on the BDAT List at the time of analysis.

ND - Constituent was not detected in the untreated waste.

ND** - Constituent was not detected in the untreated waste but was detected in the treated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Semivolatiles | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 51. Acenaphthalene | NA | NA | ND | NA | NA |
| 52. Acenaphthene | NA | NA | ND | NA | NA |
| 53. Acetophenone | NA | NA | ND | NA | NA |
| 54. 2-Acetylaminofluorene | NA | NA | A | NA | NA |
| 55. 4-Aminobiphenyl | NA | NA | ND | NA | NA |
| 56. Aniline | NA | NA | ND | NA | NA |
| 57. Anthracene | NA | NA | ND | NA | NA |
| 58. Aramite | NA | NA | A | NA | NA |
| 59. Benz(a)anthracene | NA | NA | ND | NA | NA |
| 218. Benzal chloride | NA* | NA* | NA* | NA* | NA* |
| 60. Benzenethiol | NA | NA | A | NA | NA |
| 61. Deleted | | | | | |
| 62. Benzo(a)pyrene | NA | NA | ND | NA | NA |
| 63. Benzo(b)fluoranthene | NA | NA | A | NA | NA |
| 64. Benzo(ghi)perylene | NA | NA | ND | NA | NA |
| 65. Benzo(k)fluoranthene | NA | NA | ND | NA | NA |
| 66. p-Benzoquinone | NA | NA | A | NA | NA |
| 67. Bis(2-chloroethoxy)ethane | ND | ND | ND | ND | ND |
| 68. Bis(2-chloroethyl)ether | ND | ND | D | ND | ND |
| 69. Bis(2-chloroisopropyl)ether | ND | ND | ND | ND | ND |
| 70. Bis(2-ethylhexyl)phthalate | NA | NA | ND** | NA | NA |
| 71. 4-Bromophenyl phenyl ether | ND | ND | ND | ND | ND |
| 72. Butyl benzyl phthalate | NA | NA | ND | NA | NA |
| 73. 2-sec-Butyl-4,6-dinitrophenol | NA | NA | A | NA | NA |
| 74. p-Chloroaniline | NA | NA | ND | NA | NA |
| 75. Chlorobenzilate | NA | NA | A | NA | NA |
| 76. p-Chloro-m-cresol | NA | NA | ND | NA | NA |
| 77. 2-Chloronaphthalene | ND | ND | ND | ND | ND |
| 78. 2-Chlorophenol | ND | ND | ND | ND | ND |
| 79. 3-Chloropropionitrile | NA | NA | A | NA | NA |
| 80. Chrysene | NA | NA | A | NA | NA |
| 81. ortho-Cresol | NA | NA | ND | NA | NA |
| 82. para-Cresol | NA | NA | ND | NA | NA |

A - Constituent was analyzed but a detection limit or analytical result was not obtained due to analytical problems.

D - Constituent was detected in the untreated waste.

NA - Believed that untreated waste was not analyzed for this constituent.

NA* - Untreated waste was not analyzed for this constituent because it was not on the BDAT List at the time of analysis.

ND - Constituent was not detected in the untreated waste.

ND** - Constituent was not detected in the untreated waste but was detected in the treated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Semivolatiles (Cont.) | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 232. Cyclohexanone | NA* | NA* | NA* | NA* | NA* |
| 83. Dibenz(a,h)anthracene | NA | NA | ND | NA | NA |
| 84. Dibenzo(a,e)pyrene | NA | NA | A | NA | NA |
| 85. Dibenzo(a,i)pyrene | NA | NA | A | NA | NA |
| 86. m-Dichlorobenzene | ND | ND | ND | ND | ND |
| 87. o-Dichlorobenzene | ND | ND | ND | ND | D |
| 88. p-Dichlorobenzene | ND | ND | D | ND | D |
| 89. 3,3'-Dichlorobenzidine | NA | NA | ND | NA | NA |
| 90. 2,4-Dichlorophenol | ND | ND | ND | ND | ND |
| 91. 2,6-Dichlorophenol | ND | ND | ND | ND | ND |
| 92. Diethyl phthalate | NA | NA | ND | NA | NA |
| 93. 3,3'-Dimethoxybenzidine | NA | NA | ND | NA | NA |
| 94. p-Dimethylaminoazobenzene | NA | NA | ND | NA | NA |
| 95. 3,3'-Dimethylbenzidine | NA | NA | A | NA | NA |
| 96. 2,4-Dimethylphenol | NA | NA | ND | NA | NA |
| 97. Dimethyl phthalate | NA | NA | ND | NA | NA |
| 98. Di-n-butyl phthalate | NA | NA | ND** | NA | NA |
| 99. 1,4-Dinitrobenzene | NA | NA | ND | NA | NA |
| 100. 4,6-Dinitro-o-cresol | NA | NA | ND | NA | NA |
| 101. 2,4-Dinitrophenol | NA | NA | ND | NA | NA |
| 102. 2,4-Dinitrotoluene | NA | NA | ND | NA | NA |
| 103. 2,6-Dinitrotoluene | NA | NA | ND | NA | NA |
| 104. Di-n-octyl phthalate | NA | NA | ND | NA | NA |
| 105. Di-n-propylnitrosamine | NA | NA | ND | NA | NA |
| 106. Diphenylamine/ | NA | NA | ND | NA | NA |
| 219. Diphenylnitrosamine | NA* | NA* | NA* | NA* | NA* |
| 107. 1,2-Diphenylhydrazine | NA | NA | ND | NA | NA |
| 108. Fluoranthene | NA | NA | ND | NA | NA |
| 109. Fluorene | NA | NA | D | NA | NA |
| 110. Hexachlorobenzene | D | D | D | ND | ND |

A  - Constituent was analyzed but a detection limit or analytical result was
     not obtained due to analytical problems.
D  - Constituent was detected in the untreated waste.
NA - Believed that untreated waste was not analyzed for this constituent.
NA* - Untreated waste was not analyzed for this constituent because it was
      not on the BDAT List at the time of analysis.
ND - Constituent was not detected in the untreated waste.
ND** - Constituent was not detected in the untreated waste but was detected in
       the treated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN KO16, KO18, KO19, KO20, AND KO30

| Semivolatiles (Cont.) | KO16 | KO18 | KO19 | KO20 | KO30 |
|---|---|---|---|---|---|
| 111. Hexachlorobutadiene | D | D | D | ND | D |
| 112. Hexachlorocyclopentadiene | D | ND | ND | ND | D |
| 113. Hexachloroethane | D | D | D | ND | D |
| 114. Hexachlorophene | NA | NA | A | NA | NA |
| 115. Hexachloropropene | ND | ND | ND | ND | D |
| 116. Indeno(1,2,3-cd)pyrene | NA | NA | ND | NA | NA |
| 117. Isosafrole | NA | NA | A | NA | NA |
| 118. Methapyrilene | NA | NA | A | NA | NA |
| 119. 3-Methylcholanthrene | NA | NA | A | NA | NA |
| 120. 4,4'-Methylenebis (2-chloroaniline) | NA | NA | A | NA | NA |
| 36. Methyl methanesylfonate | NA | NA | ND | NA | NA |
| 121. Naphthalene | NA | NA | D | NA | NA |
| 122. 1,4-Naphthoquinone | NA | NA | ND | NA | NA |
| 123. 1-Naphthylamine | NA | NA | ND | NA | NA |
| 124. 2-Naphthylamine | NA | NA | ND | NA | NA |
| 125. p-Nitroaniline | NA | NA | ND | NA | NA |
| 126. Nitrobenzene | NA | NA | ND | NA | NA |
| 127. 4-Nitrophenol | NA | NA | ND | NA | NA |
| 128. N-Nitrosodi-n-butylamine | NA | NA | ND | NA | NA |
| 129. N-Nitrosodiethylamine | NA | NA | ND | NA | NA |
| 130. N-Nitrosodimethylamine | NA | NA | ND | NA | NA |
| 131. N-Nitrosomethylethylamine | NA | NA | A | NA | NA |
| 132. N-Nitrosomorpholine | NA | NA | ND | NA | NA |
| 133. N-Nitrosopiperidine | NA | NA | ND | NA | NA |
| 134. n-Nitrosopyrrolidine | NA | NA | ND | NA | NA |
| 135. 5-Nitro-o-toluidine | NA | NA | A | NA | NA |
| 136. Pentachlorobenzene | ND | ND | D | ND | D |
| 137. Pentachloroethane | ND | D | ND | ND | D |
| 138. Pentachloronitrobenzene | NA | NA | ND | NA | NA |
| 139. Pentachlorophenol | ND | ND | ND | ND | ND |
| 140. Phenacetin | NA | NA | ND | NA | NA |

A - Constituent was analyzed but a detection limit or analytical result was not obtained due to analytical problems.
D - Constituent was detected in the untreated waste.
NA - Believed that untreated waste was not analyzed for this constituent.
NA* - Untreated waste was not analyzed for this constituent because it was not on the BDAT List at the time of analysis.
ND - Constituent was not detected in the untreated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Semivolatiles (Cont.) | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 141. Phenanthrene | NA | NA | D | NA | NA |
| 142. Phenol | NA | NA | ND | NA | NA |
| 143. 2-Picoline | NA | NA | ND | NA | NA |
| 144. Pronamide | NA | NA | ND | NA | NA |
| 145. Pyrene | NA | NA | ND | NA | NA |
| 146. Resorcinol | NA | NA | A | NA | NA |
| 147. Safrole | NA | NA | A | NA | NA |
| 148. 1,2,4,5-Tetrachlorobenzene | ND | ND | D | ND | D |
| 149. 2,3,4,6-Tetrachlorophenol | ND | ND | ND | ND | ND |
| 150. 1,2,4-Trichlorobenzene | ND | ND | D | ND | D |
| 151. 2,4,5-Trichlorophenol | ND | ND | ND | ND | ND |
| 152. 2,4,6-Trichlorophenol | ND | ND | ND | ND | ND |
| 153. Tris(2,3-dibromopropyl) phosphate | NA | NA | A | NA | NA |

Metals

| | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 154. Antimony | NA | NA | D | NA | NA |
| 155. Arsenic | NA | NA | D | NA | NA |
| 156. Barium | NA | NA | D | NA | NA |
| 157. Beryllium | NA | NA | D | NA | NA |
| 158. Cadmium | NA | NA | D | NA | NA |
| 159. Chromium (total) | NA | NA | D | NA | NA |
| 221. Chromium (hexavalent) | NA | NA | ND | NA | NA |
| 160. Copper | NA | NA | D | NA | NA |
| 161. Lead | NA | NA | D | NA | NA |
| 162. Mercury | NA | NA | D | NA | NA |
| 163. Nickel | NA | NA | D | NA | NA |
| 164. Selenium | NA | NA | ND | NA | NA |
| 165. Silver | NA | NA | D | NA | NA |
| 166. Thallium | NA | NA | ND | NA | NA |
| 167. Vanadium | NA | NA | D | NA | NA |
| 168. Zinc | NA | NA | D | NA | NA |

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ND - Constituent was not detected in the untreated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| Inorganics | | | | | |
| 169. Cyanide | NA | NA | ND | NA | NA |
| 170. Fluoride | NA | NA | ND | NA | NA |
| 171. Sulfide | NA | NA | D | NA | NA |
| Organochlorine Pesticides | | | | | |
| 172. Aldrin | NA** | NA** | NA** | NA** | NA** |
| 173. alpha-BHC | NA** | NA** | NA** | NA** | NA** |
| 174. beta-BHC | NA** | NA** | NA** | NA** | NA** |
| 175. delta-BHC | NA** | NA** | NA** | NA** | NA** |
| 176. gamma-BHC | NA** | NA** | NA** | NA** | NA** |
| 177. Chlordane | NA** | NA** | NA** | NA** | NA** |
| 178. DDD | NA** | NA** | NA** | NA** | NA** |
| 179. DDE | NA** | NA** | NA** | NA** | NA** |
| 180. DDT | NA** | NA** | NA** | NA** | NA** |
| 181. Dieldrin | NA** | NA** | NA** | NA** | NA** |
| 182. Endosulfan I | NA** | NA** | NA** | NA** | NA** |
| 183. Endosulfan II | NA** | NA** | NA** | NA** | NA** |
| 184. Endrin | NA** | NA** | NA** | NA** | NA** |
| 185. Endrin aldehyde | NA** | NA** | NA** | NA** | NA** |
| 186. Heptachlor | NA** | NA** | NA** | NA** | NA** |
| 187. Heptachlor epoxide | NA** | NA** | NA** | NA** | NA** |
| 188. Isodrin | NA** | NA** | NA** | NA** | NA** |
| 190. Methoxychlor | NA** | NA** | NA** | NA** | NA** |
| 191. Toxaphene | NA** | NA** | NA** | NA** | NA** |
| Phenoxyacetic Acid Herbicides | | | | | |
| 192. 2,4-Dichlorophenoxyacetic acid | NA** | NA** | NA** | NA** | NA** |
| 193. Silvex | NA** | NA** | NA** | NA** | NA** |
| 194. 2,4,5-T | NA** | NA** | NA** | NA** | NA** |

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NA - Believed that untreated waste was not analyzed for this constituent.

NA* - Untreated waste was not analyzed for this constituent because it was not on the BDAT List at the time of analysis.

NA** - Untreated waste was not analyzed for this constituent due to extreme unlikelihood that it is present in the untreated waste.

ND - Constituent was not detected in the untreated waste.

Table 5-1 (Continued)

BDAT LIST CONSTITUENTS DETECTED IN K016, K018, K019, K020, AND K030

| Organophosphorus Insecticides | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 195. Disulfoton | NA** | NA** | NA** | NA** | NA** |
| 196. Famphur | NA** | NA** | NA** | NA** | NA** |
| 197. Methyl parathion | NA** | NA** | NA** | NA** | NA** |
| 198. Parathion | NA** | NA** | NA** | NA** | NA** |
| 199. Phorate | NA** | NA** | NA** | NA** | NA** |
| **PCBs** | | | | | |
| 200. Aroclor 1016 | NA** | NA** | NA** | NA** | NA** |
| 201. Aroclor 1221 | NA** | NA** | NA** | NA** | NA** |
| 202. Aroclor 1232 | NA** | NA** | NA** | NA** | NA** |
| 203. Aroclor 1242 | NA** | NA** | NA** | NA** | NA** |
| 204. Aroclor 1248 | NA** | NA** | NA** | NA** | NA** |
| 205. Aroclor 1254 | NA** | NA** | NA** | NA** | NA** |
| 206. Aroclor 1260 | NA** | NA** | NA** | NA** | NA** |
| **Dioxins and Furans** | | | | | |
| 207. Hexachlorodibenzo-p-dioxins | NA** | NA** | NA** | NA** | NA** |
| 208. Hexachlorodibenzofuran | NA** | NA** | NA** | NA** | NA** |
| 209. Pentachlorodibenzo-p-dioxins | NA** | NA** | NA** | NA** | NA** |
| 210. Pentachlorodibenzofuran | NA** | NA** | NA** | NA** | NA** |
| 211. Tetrachlorodibenzo-p-dioxins | NA** | NA** | NA** | NA** | NA** |
| 212. Tetrachlorodibenzofuran | NA** | NA** | NA** | NA** | NA** |
| 213. 2,3,7,8-Tetrachlorodibenzo-p-dioxin | NA** | NA** | NA** | NA** | NA** |

NA** - Untreated waste was not analyzed for this constituent due to extreme unlikelihood that it is present in the untreated waste.

Table 5-2

## BDAT LIST CONSTITUENTS CONSIDERED FOR REGULATION*

### NONWASTEWATERS

| KO16 | | KO18 | | KO19 | | KO20 | | KO30 | |
|---|---|---|---|---|---|---|---|---|---|
| 42. | Tetrachloroethene | 12. | Chloroethane | 7. | Carbon tetrachloride | 23. | 1,2-Dichloroethane | 42. | Tetrachloroethene |
| 110. | Hexachlorobenzene | 15. | Chloromethane | 9. | Chlorobenzene | 41. | 1,1,2,2-Tetrachloroe-thane | 87. | o-Dichlorobenzene |
| 111. | Hexachlorobutadiene | 22. | 1,1-Dichloroethane | 14. | Chloroform | 42. | Tetrachloroethene | 88. | p-Dichlorobenzene |
| 112. | Hexachlorocyclopent-adiene | 23. | 1,2-Dichloroethane | 22. | 1,1-Dichloroethane | 46. | 1,1,2-Trichloro-ethane | 111. | Hexachlorobutadiene |
| 113. | Hexachloroethane | 45. | 1,1,1-Trichloro-ethane | 23. | 1,2-Dichloroethane | | | 112. | Hexachlorocyclopent-adiene |
| | | 46. | 1,1,2-Trichloroethane | 41. | 1,1,2,2-Tetrachloroe-thane | | | 113. | Hexachloroethane |
| | | 98. | Di-n-butyl phthalate | 42. | Tetrachloroethene | | | 115. | Hexachloropropene |
| | | 110. | Hexachlorobenzene | 45. | 1,1,1-Trichloro-thane | | | 136. | Pentachlorobenzene |
| | | 111. | Hexachlorobutadiene | 46. | 1,1,2-Trichloroe-thane | | | 137. | Pentachloroethane |
| | | 113. | Hexachloroethane | 47. | Trichloroethene | | | 148. | 1,2,4,5-Tetrachloro-benzene |
| | | 137. | Pentachloroethane | 68. | Bis(2-chloroethyl)-ether | | | 150. | 1,2,4-Trichloroben-zene |
| | | | | 70. | Bis(2-ethylhexyl)-phthalate | | | | |
| | | | | 88. | p-Dichlorobenzene | | | | |
| | | | | 98. | Di-n-butyl phthalate | | | | |
| | | | | 109. | Fluorene | | | | |
| | | | | 110. | Hexachlorobenzene | | | | |
| | | | | 111. | Hexachlorobutadiene | | | | |
| | | | | 113. | Hexachloroethane | | | | |
| | | | | 121. | Naphthalene | | | | |
| | | | | 136. | Pentachlorobenzene | | | | |
| | | | | 141. | Phenanthrene | | | | |
| | | | | 148. | 1,2,4,5-Tetrachloro-benzene | | | | |
| | | | | 150. | 1,2,4-Trichloroben-zene | | | | |

*All constituents on this list were detected in the KO16, KO18, KO19, KO20, or KO30 wastes and were either selected for regulation (as shown in Table 5-3) or are believed to be controlled by regulation of another constituent.

5-25

Table 5-2 (Continued)

# BDAT LIST CONSTITUENTS CONSIDERED FOR REGULATION*

## WASTEWATERS (Selection Method Considered for the Final Rule)

| K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|
| 42. Tetrachloroethene | 12. Chloroethane | 7. Carbon tetrachloride | 23. 1,2-Dichloroethane | 42. Tetrachloroethene |
| 110. Hexachlorobenzene | 15. Chloromethane | 9. Chlorobenzene | 41. 1,1,2,2-Tetrachloro- | 87. o-Dichlorobenzene |
| 111. Hexachlorobutadiene | 22. 1,1-Dichloroethane | 14. Chloroform | ethane | 88. p-Dichlorobenzene |
| 112. Hexachlorocyclopent- | 23. 1,2-Dichloroethane | 21. Dichlorodifluoro- | 42. Tetrachloroethene | 111. Hexachlorobutadiene |
| adiene | 45. 1,1,1-Trichloro- | methane | 46. 1,1,2-Trichloro- | 112. Hexachlorocyclopent- |
| 113. Hexachloroethane | ethane | 22. 1,1-Dichloroethane | ethane | adiene |
|  | 46. 1,1,2-Trichloroethane | 23. 1,2-Dichloroethane |  | 113. Hexachloroethane |
|  | 98. Di-n-butyl phthalate | 41. 1,1,2,2-Tetra- |  | 115. Hexachloropropene |
|  | 110. Hexachlorobenzene | chloroethane |  | 136. Pentachlorobenzene |
|  | 111. Hexachlorobutadiene | 42. Tetrachloroethene |  | 137. Pentachloroethane |
|  | 113. Hexachloroethane | 43. Toluene |  | 148. 1,2,4,5-Tetrachloro- |
|  | 137. Pentachloroethane | 45. 1,1,1-Trichloro- |  | benzene |
|  |  | ethane |  | 150. 1,2,4-Trichloroben- |
|  |  | 46. 1,1,2-Trichloro- |  | zene |
|  |  | ethane |  |  |
|  |  | 47. Trichloroethene |  |  |
|  |  | 68. Bis(2-chloroethyl)- |  |  |
|  |  | ether |  |  |
|  |  | 70. Bis(2-ethylhexyl)- |  |  |
|  |  | phthalate |  |  |
|  |  | 88. p-Dichlorobenzene |  |  |
|  |  | 98. Di-n-butyl phthalate |  |  |
|  |  | 109. Fluorene |  |  |
|  |  | 110. Hexachlorobenzene |  |  |
|  |  | 111. Hexachlorobutadiene |  |  |
|  |  | 113. Hexachloroethane |  |  |
|  |  | 121. Naphthalene |  |  |
|  |  | 136. Pentachlorobenzene |  |  |
|  |  | 141. Phenanthrene |  |  |
|  |  | 148. 1,2,4,5-Tetrachloro- |  |  |
|  |  | benzene |  |  |
|  |  | 150. 1,2,4-Trichloroben- |  |  |
|  |  | zene |  |  |

*All constituents on this list were detected in the K016, K018, K019, K020, or K030 wastes and were either selected for regulation under the selection method considered for the final rule (as shown in Table 5-4) or are believed to be controlled by regulation of another constituent.

## Table 5-3

## BDAT LIST CONSTITUENTS SELECTED FOR REGULATION

**NONWASTEWATERS**

| | K016 | | K018 | | K019 | | K020 | | K030 |
|---|---|---|---|---|---|---|---|---|---|
| 42. | Tetrachloroethene | 12. | Chloroethane | 9. | Chlorobenzene | 23. | 1,2-Dichloroethane | 42. | Tetrachloroethene |
| 110. | Hexachlorobenzene | 22. | 1,1-Dichloroethane | 14. | Chloroform | 41. | 1,1,2,2-Tetrachloro- | 111. | Hexachlorobutadiene |
| 111. | Hexachlorobutadiene | 23. | 1,2-Dichloroethane | 23. | 1,2-Dichloroethane | | ethane | 113. | Hexachloroethane |
| 112. | Hexachlorocyclopent- | 45. | 1,1,1-Trichloro- | 42. | Tetrachloroethene | 42. | Tetrachloroethene | 115. | Hexachloropropene |
| | adiene | | ethane | 45. | 1,1,1-Trichloro- | | | 136. | Pentachlorobenzene |
| 113. | Hexachloroethane | 110. | Hexachlorobenzene | | ethane | | | 137. | Pentachloroethane |
| | | 111. | Hexachlorobutadiene | 68. | Bis(2-chloroethyl)- | | | 148. | 1,2,4,5-Tetrachloro- |
| | | 113. | Hexachloroethane | | ether | | | | benzene |
| | | 137. | Pentachloroethane | 113. | Hexachloroethane | | | 150. | 1,2,4-Trichloroben- |
| | | | | 121. | Naphthalene | | | | zene |
| | | | | 141. | Phenanthrene | | | | |
| | | | | 150. | 1,2,4-Trichloroben- | | | | |
| | | | | | zene | | | | |

Table 5-3 (Continued)

## BDAT LIST CONSTITUENTS SELECTED FOR REGULATION

WASTEWATERS (Method used in Proposed Rule)

| K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|
| 42. Tetrachloroethene | 12. Chloroethane | 7. Carbon Tetrachloride | 23. 1,2-Dichloroethane | 42. Tetrachloroethene |
| 110. Hexachlorobenzene | 15. Chloromethane | 14. Chloroform | 41. 1,1,2,2-Tetrachloroethane | 111. Hexachlorobutadiene |
| 111. Hexachlorobutadiene | 22. 1,1-Dichloroethane | 23. 1,2-Dichloroethane | 42. Tetrachloroethene | 113. Hexachloroethane |
| 112. Hexachlorocyclo- pentadiene | 23. 1,2-Dichloroethane | 42. Tetrachloroethene | 113. Hexachloroethane | 115. Hexachloropropane |
| 113. Hexachloroethane | 45. 1,1,1-Trichloro- ethane | 46. 1,1,2-Trichloroethane | 137. Pentachloroethane | 137. Pentachloroethane |
| | 110. Hexachlorobenzene | 68. Bis(2-chloroethyl) ether | | 148. 1,2,4,5-Tetrachloro- benzene |
| | 111. Hexachlorobuta- diene | 88. p-Dichlorobenzene | | 150. 1,2,4-Trichloro- benzene |
| | 137. Pentachloroethane | 110. Hexachlorobenzene | | |
| | | 113. Hexachloroethane | | |
| | | 121. Naphthalene | | |
| | | 136. Pentachlorobenzene | | |
| | | 148. 1,2,4,5-Tetrachloro- benzene | | |
| | | 150. 1,2,4-Trichlorobenzene | | |

## Table 5-4

## BDAT LIST CONSTITUENTS SELECTED FOR REGULATION*

WASTEWATERS (Method to be Considered for the Final Rule)

| KO16 | | KO18 | | KO19 | | KO20 | | KO30 | |
|------|---|------|---|------|---|------|---|------|---|
| 42. | Tetrachloroethene | 12. | Chloroethane | 9. | Chlorobenzene | 23. | 1,2-Dichloroethane | 42. | Tetrachloroethene |
| 110. | Hexachlorobenzene | 15. | Chloromethane | 14. | Chloroform | 41. | 1,1,2,2-Tetrachloro- | 87. | o-Dichlorobenzene |
| 111. | Hexachlorobutadiene | 22. | 1,1-Dichloroethane | 23. | 1,2-Dichloroethane | | ethane | 88. | p-Dichlorobenzene |
| 112. | Hexachlorocyclopent- | 23. | 1,2-Dichloroethane | 42. | Tetrachloroethene | 42. | Tetrachloroethene | 111. | Hexachlorobutadiene |
| | adiene | 45. | 1,1,1-Trichloro- | 45. | 1,1,1-Trichloro- | | | 113. | Hexachloroethane |
| 113. | Hexachloroethane | | ethane | | ethane | | | 137. | Pentachloroethane |
| | | 110. | Hexachlorobenzene | 68. | Bis(2-chloroethyl)- | | | 148. | 1,2,4,5-Tetrachloro- |
| | | 111. | Hexachlorobutadiene | | ether | | | | benzene |
| | | 137. | Pentachloroethane | 88. | p-Dichlorobenzene | | | 150. | 1,2,4-Trichloroben- |
| | | | | 109. | Fluorene | | | | zene |
| | | | | 113. | Hexachloroethane | | | | |
| | | | | 121. | Naphthalene | | | | |
| | | | | 141. | Phenanthrene | | | | |
| | | | | 148. | 1,2,4,5-Tetrachloro- | | | | |
| | | | | | benzene | | | | |
| | | | | 150. | 1,2,4-Trichloroben- | | | | |
| | | | | | zene | | | | |

*This table presents the constituents selected for regulation in KO16, KO18, KO19, KO20, and KO30 wastewaters according to the selection method to be considered for the final rule. The constituents proposed for regulation are presented in Table 5-3.

# 6.0 CALCULATION OF TREATMENT STANDARDS

In Section 4.0 of this document, the best demonstrated and available technology for treatment of K016, K018, K019, K020, and K030 was chosen based on available performance data. In Section 5.0, the regulated constituents were selected in order to ensure effective treatment of the wastes. The purpose of Section 6.0 is to calculate treatment standards for each of the regulated constituents using the available treatment data from the BDAT treatment technology. Included in this section is a step-by-step discussion of the calculation of treatment standards for the nonwastewater and wastewater forms of K016, K018, K019, K020, and K030.

Rotary kiln incineration was determined to be BDAT (see Section 4.0) for K016, K018, K019, K020, and K030. Rotary kiln incineration generally results in the generation of two treatment residuals: ash (a nonwastewater form of K016, K018, K019, K020, and K030) and combustion gas scrubber water (a wastewater form of K016, K018, K019, K020, and K030). The best measure of performance for a destruction technology, such as rotary kiln incineration, is the total amount of constituent remaining after treatment. Therefore, proposed BDAT treatment standards for organic constituents were calculated based on total constituent concentration data.

6.1    Calculation of Treatment Standards for Nonwastewater Forms of K016,
       K018, K019, K020, and K030

       K019

       Six data sets for rotary kiln incineration were used to calculate

the nonwastewater treatment standards for K019. Table 6-1 presents the

concentration values for organic constituents in the treatment residual (ash)

resulting from rotary kiln incineration of K019 at plant A. Values are

presented for constituents (detected in the untreated K019) that are being

proposed for regulation in K016, K018, K019, K020, and K030. The

concentration data presented in Table 6-1 have been corrected to account for

analytical recovery as described in Section 4.0.

       Nonwastewater treatment standards were calculated for each regulated

constituent for K019 as shown in Table 6-4. The following three steps were

used to calculate the treatment standards:   (1) The arithmetic average of the

corrected treatment values for each regulated constituent was calculated using

the six data points presented in Table 6-1.   (2) Using these same data, a

variability factor was calculated that represents the variability inherent in

the performance of the treatment system, collection of treated samples, and

analysis of samples. Where concentrations in the treated waste were reported

as less than or equal to the detection limit for all the data points in the

data set, variability is still expected since the actual concentrations could

range from 0 to the detection limit. In these cases, the Agency assumed a

lognormal distribution of data points between the detection limit and a value

1/10 of the detection limit and calculated a variability factor of 2.8.

(3) The treatment standard for each regulated constituent was calculated by

multiplying the arithmetic average of the corrected treatment values by the

variability factor. The analytical methods for analysis of each regulated

constituent in K019 are included in Table 6-4. A detailed discussion of these

analytical methods is presented in Appendix D (Analytical QA/QC).


### K016, K018, K020, and K030


Treatment performance data from rotary kiln incineration of K016,

K018, K020, and K030 are not available. Therefore, the Agency is transferring

performance data from the treatment of K019 at plant A to K016, K018, K020,

and K030. The calculations of treatment standards for K016, K018, K020, and

K030 are presented in Tables 6-2, 6-3, 6-5, and 6-6, respectively. The

transfer of treatment data is supported by the determination that K016, K018,

K019, K020, and K030 represent a single waste treatability group, as discussed

in Section 2.0. The determination of the waste treatability group is based on

the similarity in composition of the untreated wastes, the fact that all of

these wastes are generated by the organic chemicals industry, and the Agency's

belief that constituents present in these wastes can be treated to similar

concentrations using the same technology.


Where treatment data are available from treatment of K019 for a

proposed regulated constituent in K016, K018, K020, and K030, the data were

transferred to that constituent to calculate the treatment standard for each waste code. For example, 1,1-dichloroethane was selected for regulation in K018. 1,1-Dichloroethane was detected in the untreated K019 at a concentration of 2,200 ppm and was treated to not detect values in the treatment residual (kiln ash residue) from treatment of K019 at plant A. Treatment data (in this case: not detect values) for 1,1-dichloroethane from K019 were transferred to 1,1-dichloroethane in K018 to calculate the treatment standard. 1,1-Dichloroethane was not selected for regulation in K019, however, because it was found in lower concentrations in the untreated K019 waste compared with concentrations of other constituents that were selected for regulation and because it is believed to be adequately controlled by incineration of other consituents that were selected for regulation. Treatment performance data were transferred in this way for most organic constituents in K016, K018, K020, and K030 that are being proposed for regulation.

Treatment performance data were not available from treatment of K019 at plant A for some organic constituents proposed for regulation in K016, K018, K020, and K030. This is because the constituents proposed for regulation for each waste code are based on available waste characterization data from a variety of sources. Not all constituents proposed for regulation in K016, K018, K020, and K030 were detected in the K019 treated at plant A. The Agency believes that it would be inappropriate to base treatment standards on not detect values in the treatment residual of K019 if the constituent was not detected in the untreated K019. In such cases, data were transferred to that organic constituent from another organic constituent detected in the untreated K019 based on the boiling points of the constituents. (Boiling

point is a waste characteristic that affects the performance of rotary kiln incineration as discussed in Section 3.4. Appendix E presents information on waste characteristics that affect performance.) The constituent with the same or the closest higher boiling point for which the Agency had treatment performance data from K019 at plant A was selected for transfer of data. Cases where such a transfer of data occurred are summarized below and are noted on Tables 6-2, 6-3, 6-5, and 6-6, which show the calculations of the treatment standards for K016, K018, K020, and K030, respectively.

12. Chloroethane (K018). The treatment standard proposed for regulation of chloroethane (bp 12°C) in K018 is based on data transferred from treatment of chloroform (bp 61°C) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that chloroethane can be treated to concentration levels as low or lower than chloroform.

41. 1,1,2,2-Tetrachloroethane (K020). The treatment standard proposed for 1,1,2,2-tetrachloroethane (bp 147°C) in K020 is based on data transferred from treatment of bis(2-chloroethyl)ether (bp 178°C) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that 1,1,2,2-tetrachloroethane can be treated to concentration levels as low or lower than bis(2-chloroethyl)ether.

111. <u>Hexachlorobutadiene (K016, K018, K030)</u>. The treatment standard proposed for hexachlorobutadiene (bp 215°C) in K016, K018, and K030 is based on data transferred from treatment of naphthalene (bp 218°C) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that hexachlorobutadiene can be treated to concentration levels as low or lower than naphthalene.

112. <u>Hexachlorocyclopentadiene (K016)</u>. The treatment standard proposed for hexachlorocylopentadiene (bp 234°C) in K016 is based on data transferred from treatment of phenanthrene (bp 340°C) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that hexachlorocylopentadiene can be treated to concentration levels as low or lower than phenanthrene.

115. <u>Hexachloropropene (K030)</u>. The treatment standard proposed for hexachloropropene (bp 209°C) in K030 is based on data transferred from treatment of 1,2,4-trichlorobenzene (bp 213°C) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that hexachloropropene can be treated to concentration levels as low or lower than 1,2,4-trichlorobenzene.

137. <u>Pentachloroethane (K018, K030)</u>. The treatment standard proposed for pentachloroethane (bp 161°C) in K018 and K030 is based on data

transferred from treatment of bis(2-chloroethyl)ether (bp 178°C) in K019.

Based on the discussion of waste characteristics affecting treatment perfor-

mance of rotary kiln incineration in Section 3.4, the Agency expects that

pentachloroethane can be treated to concentration levels as low or lower than

bis(2-chloroethyl)ether.


## 6.2 Calculation of Treatment Standards for Wastewater Forms of K016, K018, K019, K020, and K030

Two methods for calculation of wastewater treatment standards are

presented here:  the method used in the proposed rule, and an alternative

method to be considered for the final rule.  The calculation of treatment

standards for the proposed rule is presented in Section 6.2.1.  The

calculation of treatment standards by an alternative method to be considered

for the final rule, is presented in Section 6.2.2.


### 6.2.1 Calculation of Treatment Standards in Proposed Rule

#### K019

Six data sets for rotary kiln incineration were used to calculate

the wastewater treatment standards for K019.  Table 6-7 presents the concen-

tration values for organic constituents in the treatment residual (scrubber

water) resulting from rotary kiln incineration of K019 at plant A.  The

concentration data presented in Table 6-7 have been corrected to account for analytical recovery as described in Section 4.0.

Wastewater treatment standards were calculated for each regulated constituent for KO19 as shown in Table 6-10. The following three steps were used to calculate the treatment standards: (1) The arithmetic average of the corrected treatment values for each regulated constituent was calculated using the six data points presented in Table 6-7. (2) Using these same data, a variability factor was calculated that represents the variability inherent in the performance of treatment systems, collection of treated samples, and analysis of samples. Where concentrations in the treated waste were reported as less than or equal to the detection limit for all the data points in the data set, variability is still expected since the actual concentrations could range from 0 to the detection limit. In these cases, the Agency used the average variability factor of 3.01 from (dichlorodifluoromethane, toluene, and di-n-butyl phthalate) calculated for detected organic constituents in the scrubber water. (3) The treatment standard for each regulated constituent was calculated by multiplying the arithmetic average of the corrected treatment values by the variability factor. The analytical methods upon which the treatment standards for KO19 are based are included in Table 6-10. A detailed discussion of these analytical methods is presented in Appendix D (Analytical QA/QC).

## KO16, KO18, KO20, and KO30

Treatment performance data from rotary kiln incineration of KO16, KO18, KO20, and KO30 are not available. Therefore, the Agency is transferring treatment performance data from the treatment of KO19 at plant A to KO16, KO18, KO20, and KO30. The calculation of treatment standards for KO16, KO18, KO20, and KO30 are presented in Tables 6-8, 6-9, 6-11, and 6-12, respectively. The transfer of treatment performance data is supported by the determination that KO16, KO18, KO19, KO20, and KO30 represent a single waste treatability group, as discussed in Section 2.0. The determination of the waste treatability group is based on the similarity in composition of the untreated wastes, the fact that all of these wastes are generated by the organic chemicals industry, and the Agency's belief that constituents present in these wastes can be treated to similar concentrations using the same technologies.

Treatment performance data were not available from treatment of KO19 at plant A for some organic constituents proposed for regulation in KO16, KO18, KO20, and KO30. This is because the constituents proposed for regulation for each waste code are based on available waste characterization data from a variety of sources. Not all constituents proposed for regulation in KO16, KO18, KO20, and KO30 were detected in the KO19 treated at plant A. The Agency believes that it would be inappropriate to base treatment standards on not detect values in the treatment residual of KO19 if the constituent was also not detected in the untreated KO19. In such cases, data were transferred to that organic constituent from another organic constituent detected in the

untreated K019 based on the boiling point of the constituents. The constituent with the same or the closest higher boiling point for which the Agency had treatment data from K019 at plant A was selected for transfer of data. Cases where treatment performance data were transferred are summarized below and are noted on Tables 6-8, 6-9, 6-11, and 6-12.

12. Chloroethane (K018). The treatment standard proposed for chloroethane (bp 12.3°C) in K018 is based on data transferred from treatment of chloroform (bp 62°C) in K019.

15. Chloromethane (K018). The treatment standard proposed for chloromethane (bp 12.3°C) in K018 is based on data transferred from treatment of chloroform (bp 62°C) in K019.

22. 1,1-Dichloroethane (K018). The treatment standard proposed for 1,1-dichloroethane (bp 57.3°C) in K018 is based on data transferred from treatment of chloroform (bp 62°C) in K019.

41. 1,1,2,2-Tetrachloroethane (K020). The treatment standard proposed for 1,1,2,2-tetrachloroethane (bp 147°C) in K020 is based on data transferred from treatment of p-dichlorobenzene bp 174°C) in K019.

45. 1,1,1-Trichloroethane (K018). The treatment standard proposed for 1,1,1-trichloroethane (bp 74.1°C) in K018 is based on data transferred from treatment of carbon tetrachloride (bp 77°C) in K019.

111.  Hexachlorobutadiene (KO16, KO18, KO30). The treatment stan-
dard proposed for hexachlorobutadiene (bp 220°C) in KO16, KO18, and KO30 is
based on data transferred from treatment of naphthalene (bp 218°C) in KO19.


112.  Hexachlorocyclopentadiene (KO16). The treatment standard
proposed for hexachlorocyclopentadiene (bp 234°C) in KO16 is based on data
transferred from treatment of 1,2,4,5-tetrachlorobenzene (bp 246°C) in KO19.


115.  Hexachloropropene (KO30). The treatment standard proposed for
hexachloropropene (bp 210°C) in KO30 is based on data transferred from treat-
ment of 1,2,4-trichlorobenzene (bp 213°) in KO19.


137.  Pentachloroethane (KO18, KO30). The treatment standard
proposed for pentachloroethane (bp 162°C) in KO18 and KO30 is based on data
transferred from treatment of p-dichlorobenzene (bp 174°C) in KO19.


6.2.2    Calculation of Treatment Standards by an Alternative Method to be
         Considered for the final Rule


KO19


Six data sets for rotary kiln incineration were used to calculate
the wastewater treatment standards for KO19. Table 6-13 presents the
concentration values for organic constituents in the treatment residual

(scrubber water) resulting from rotary kiln incineration of K019 at plant A. Values are presented for constituents (detected in the untreated K019) that are being proposed for regulation of K016, K018, K019, K020, and K030. The concentration data presented in Table 6-13 have been corrected to account for analytical recovery as described in Section 4.0.

Wastewater treatment standards were calculated for each regulated constituent for K019 as shown in Table 6-16. The following three steps were used to calculate the treatment standards: (1) The arithmetic average of the corrected treatment values for each regulated constituent was calculated using the six data points presented in Table 6-13. (2) Using these same data, a variability factor was calculated that represents the variability inherent in the performance of the treatment system, collection of treated samples, and analysis of samples. Where concentrations in the treated waste were reported as less than or equal to the detection limit for all the data points in the data set, variability is still expected since the actual concentrations could range from 0 to the detection limit. In these cases, the Agency assumed a lognormal distribution of data points between the detection limit and a value 1/10 of the detection limit and calculated a variability factor of 2.8. (3) The treatment standard for each regulated constituent was calculated by multiplying the arithmetic average of the corrected treatment values by the variability factor. The analytical methods upon which the treatment standards for K019 are based are included in Table 6-16. A detailed discussion of these analytical methods is presented in Appendix D (Analytical QA/QC).

## K016, K018, K020, and K030

Treatment performance data from rotary kiln incineration of K016, K018, K020, and K030 are not available. Therefore, the Agency is transferring data from the treatment of K019 at plant A to K016, K018, K020, and K030. The calculations of treatment standards for K016, K018, K020, and K030 are presented in Tables 6-14, 6-15, 6-17, and 6-18, respectively. The transfer of treatment data is supported by the determination that K016, K018, K019, K020, and K030 represent a single waste treatability group, as discussed in Section 2.0. The determination of the waste treatability group is based on the similarity in composition of the untreated wastes, the fact that all of these wastes are generated by the organic chemicals industry, and the Agency's belief that constituents present in these wastes can be treated to similar concentrations using the same technology.

Where treatment data are available from treatment of K019 for a proposed regulated constituent in K016, K018, K020, and K030, the data were transferred to that constituent to calculate the treatment standard for each waste code. For example, 1,1-dichloroethane was selected for regulation in K018. 1,1-Dichloroethane was detected in the untreated K019 at a concentration of 2,200 ppm and was treated to not detect values in the treatment residual (combustion gas scrubber water) from treatment of K019 at plant A. Treatment data (in this case: not detect values) for 1,1-dichloroethane from K019 were transferred to 1,1-dichloroethane in K018 to calculate the treatment

standard. 1,1-Dichloroethane was not selected for regulation in K019, however, because it was found in lower concentrations in the untreated K019 waste compared with concentrations of other constituents that were selected for regulation and because it is believed to be adequately controlled by incineration of other constituents that were selected for regulation. Treatment performance data were transferred in this way for most organic constituents in K016, K018, K020, and K030 that are being proposed for regulation.

Treatment performance data were not available from treatment of K019 at plant A for some organic constituents proposed for regulation in K016, K018, K020, and K030. This is because the constituents proposed for regulation for each waste code are based on available waste characterization data from a variety of sources. Not all constituents proposed for regulation in K016, K018, K020, and K030 were detected in the K019 treated at plant A. The Agency believes that it would be inappropriate to base treatment standards on not detect values in the treatment residual of K019 if the constituent was not detected in the untreated K019. In such cases, data were transferred to that organic constituent from another organic constituent detected in the untreated K019 based on the bond dissociation energy of the constituents. (Bond dissociation energy (BDE) is a waste characteristic that affects the performance of rotary kiln incineration as discussed in Section 3.4.) The constituent with the same or the closest higher bond dissociation energy for which the Agency had treatment data from K019 at plant A was selected for transfer of data. Cases where such a transfer of data occurred are summarized

below and are noted on Tables 6-14, 6-15, 6-17, and 6-18, which show the calculations of the treatment standards for K016, K018, K020, and K030, respectively.

12. Chloroethane (K018). The treatment standard proposed for chloroethane (BDE 665 kcal/mol) in K018 is based on data transferred from treatment of bis(2-chloroethyl)ether (BDE 1,290 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that chloroethane can be treated to concentration levels as low or lower than bis(2-chloro-ethyl)ether.

15. Chloromethane (K018). The treatment standard proposed for chloromethane (BDE 380 kcal/mol) in K018 is based on data transferred from treatment of tetrachloroethene (BDE 461 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that chloromethane can be treated to concentration levels as low or lower than tetrachloroethene.

41. 1,1,2,2-Tetrachloroethane (K020). The treatment standard proposed for 1,1,2,2-tetrachloroethane (BDE 605 kcal/mol) in K020 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE 625 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that 1,1,2,2-tetrachloroethane can be treated to concentration levels as low or lower than 1,1,1-trichloroethane.

87. o-Dichlorobenzene (K030). The treatment standard proposed for o-dichlorobenzene (BDE 1,325 kcal/mol) in K030 is based on data transferred from treatment of p-dichlorobenzene (BDE 1,325 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that o-dichlorobenzene can be treated to concentration levels as low or lower than p-dichlorobenzene.


111. Hexachlorobutadiene (K016, K018, K030). The treatment standard proposed for hexachlorobutadiene (BDE 853 kcal/mol) in K016, K018, and K030 is based on data transferred from treatment of bis(2-chloroethyl)ether (BDE 1,290 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that hexachlorobutadiene can be treated to concentration levels as low or lower than bis(2-chloroethyl)ether.


112. Hexachlorocyclopentadiene (K016). The treatment standard proposed for hexachlorocyclopentadiene (BDE 1,020 kcal/mol) in K016 is based on data transferred from treatment of bis(2-chloroethyl)ether (BDE 1,290 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that hexachlorocyclopentadiene can be treated to concentration levels as low or lower than bis(2-chloroethyl)ether.

137. Pentachloroethane (K018, K030). The treatment standard proposed for pentachloroethane (BDE 585 kcal/mol) in K018 and K030 is based on data transferred from treatment of 1,1,1-trichloroethane (BDE 625 kcal/mol) in K019. Based on the discussion of waste characteristics affecting treatment performance of rotary kiln incineration in Section 3.4, the Agency expects that pentachloroethane can be treated to concentration levels as low or lower than 1,1,1-trichloroethane.

Table 6-1

CORRECTED TOTAL CONCENTRATION DATA
FOR ORGANICS IN ROTARY KILN INCINERATOR ASH FROM TREATMENT OF K019

| Constituent* | Corrected Concentrations in the Treated Waste, ppm | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Volatiles** | | | | | | |
| 9. Chlorobenzene | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 | 2.02 |
| 14. Chloroform | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 22. 1,1-Dichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 23. 1,2-Dichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 42. Tetrachloroethene | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| 45. 1,1,1-Trichloroethane | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 | 2.13 |
| **Semivolatiles** | | | | | | |
| 68. Bis(2-chloroethyl)ether | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 110. Hexachlorobenzene | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 113. Hexachloroethane | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 121. Naphthalene | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 136. Pentachlorobenzene | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 | 9.71 |
| 141. Phenanthrene | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 | 1.94 |
| 148. 1,2,4,5-Tetrachlorobenzene | 4.85 | 4.85 | 4.85 | 4.85 | 4.85 | 4.85 |
| 150. 1,2,4-Trichlorobenzene | 6.67 | 6.67 | 6.67 | 6.67 | 6.67 | 6.67 |

*Constituents proposed for regulation and present in untreated K019.

Table 6-2

CALCULATION OF NONWASTEWATER TREATMENT STANDARDS FOR K016

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF) (ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6.00-78,000 | 2.13 | 2.8 | 5.96 |
| Semivolatiles (8270) (Total Concentration) | | | | | |
| 110. Hexachlorobenzene | Hexachlorobenzene | 60-87 | 9.71 | 2.8 | 27.2 |
| 111. Hexachlorobutadiene | Naphthalene | 314-470 | 1.94 | 2.8 | 5.44 |
| 112. Hexachlorocyclopenta-diene | Phenanthrene | 11-21 | 1.94 | 2.8 | 5.44 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 9.71 | 2.8 | 27.2 |

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-3

CALCULATION OF NONWASTEWATER TREATMENT STANDARDS FOR K018

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF) (ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 12.  Chloroethane | Chloroform | 4,600-6,000 | 2.13 | 2.8 | 5.96 |
| 22.  1,1-Dichloroethane | 1,1-Dichloroethane | <2,000-2,200 | 2.13 | 2.8 | 5.96 |
| 23.  1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 2.13 | 2.8 | 5.96 |
| 45.  1,1,1-Trichloroethane | 1,1,1-Trichloroethane | 2,200-3,210 | 2.13 | 2.8 | 5.96 |
| Semivolatiles (8270) (Total Concentration) | | | | | |
| 110.  Hexachlorobenzene | Hexachlorobenzene | 60-87 | 9.71 | 2.8 | 27.2 |
| 111.  Hexachlorobutadiene | Naphthalene | 314-470 | 1.94 | 2.8 | 5.44 |
| 113.  Hexachloroethane | Hexachloroethane | 85-120 | 9.71 | 2.8 | 27.2 |
| 137.  Pentachloroethane | Bis(2-chloroethyl)ether | 280-340 | 1.94 | 2.8 | 5.44 |

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-4

CALCULATION OF NONWASTEWATER TREATMENT STANDARDS FOR K019

| Regulated Constituent (SW-846 Method Number)[1] | Untreated K019 at Plant A* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF) (ppm) |
|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | |
| 9. Chlorobenzene | <2000-3000 | 2.02 | 2.8 | 5.66 |
| 14. Chloroform | 4600-6000 | 2.13 | 2.8 | 5.96 |
| 23. 1,2-Dichloroethane | 87000-122000 | 2.13 | 2.8 | 5.96 |
| 42. Tetrachloroethene | 6000-78000 | 2.13 | 2.8 | 5.96 |
| 45. 1,1,1-Trichloroethane | 2200-3210 | 2.13 | 2.8 | 5.96 |
| Semivolatiles (8270) (Total Concentration) | | | | |
| 68. Bis(2-chloroethyl)ether | 280-340 | 1.94 | 2.8 | 5.44 |
| 113. Hexachloroethane | 85-120 | 9.71 | 2.8 | 27.2 |
| 121. Naphthalene | 314-470 | 1.94 | 2.8 | 5.44 |
| 141. Phenanthrene | 11-21 | 1.94 | 2.8 | 5.44 |
| 150. 1,2,4-Trichlorobenzene | 65-100 | 6.67 | 2.8 | 18.7 |

*Concentration values for the untreated waste have not been corrected for recovery.

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-5

CALCULATION OF NONWASTEWATER TREATMENT STANDARDS FOR K020

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF) (ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 23. 1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 2.00 | 2.8 | 5.96 |
| 41. 1,1,2,2-Tetrachloroethane | Bis(2-chloroethyl)-ether | 280-340 | 1.94 | 2.8 | 5.44 |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 2.13 | 2.8 | 5.96 |
| Semivolatiles (8270) (Total Concentration) | | | | | |

No semivolatile organics are being proposed for regulation for this waste code.

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

* This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-6

CALCULATION OF NONWASTEWATER TREATMENT STANDARDS FOR K030

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF) (ppm) |
|---|---|---|---|---|---|
| **Volatiles (8240)** **(Total Concentration)** | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 2.13 | 2.8 | 5.96 |
| **Semivolatiles (8270)** **(Total Concentration)** | | | | | |
| 111. Hexachlorobutadiene | Naphthalene | 314-470 | 1.94 | 2.8 | 5.44 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 9.71 | 2.8 | 27.2 |
| 115. Hexachloropropene | 1,2,4-Trichlorobenzene | 65-100 | 6.67 | 2.8 | 18.7 |
| 136. Pentachlorobenzene | Pentachlorobenzene | 51-65 | 9.71 | 2.8 | 27.2 |
| 137. Pentachloroethane | Bis(2-chloroethyl)ether | 280-340 | 1.94 | 2.8 | 5.44 |
| 148. 1,2,4,5-Tetrachlorobenzene | 1,2,4,5-Tetrachlorobenzene | 62-86 | 4.85 | 2.8 | 13.6 |
| 150. 1,2,4-Trichlorobenzene | 1,2,4-Trichlorobenzene | 65-100 | 6.67 | 2.8 | 18.7 |

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

* This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-7

CORRECTED TOTAL CONCENTRATION DATA FOR ORGANICS
IN ROTARY KILN SCRUBBER WATER FROM TREATMENT OF KO19

| Constituent* | Corrected Concentration in the Treated Waste, ppm | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Volatiles | | | | | | |
| 7. Carbon tetrachloride | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 14. Chloroform | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 23. 1,2-Dichloroethane | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 42. Tetrachloroethene | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| 46. 1,1,2-Trichloroethane | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| Semivolatiles | | | | | | |
| 68. Bis(2-chloroethyl)ether | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 88. p-Dichlorobenzene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 110. Hexachlorobenzene | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 113. Hexachloroethane | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 121. Naphthalene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 136. Pentachlorobenzene | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| 148. 1,2,4,5-Tetrachlorobenzene | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |
| 150. 1,2,4-Trichlorobenzene | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

*Constituents proposed for regulation and present in untreated KO19.

Table 6-8

CALCULATION OF PROPOSED WASTEWATER TREATMENT STANDARDS FOR K016

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.005 | 3.01 | 0.014 |
| Semivolatiles (8270) (Total Concentration) | | | | | |
| 110. Hexachlorobenzene | Hexachlorobenzene | 60-87 | 0.017 | 3.01 | 0.050 |
| 111. Hexachlorobutadiene | Naphthalene | 314-470 | 0.003 | 3.01 | 0.010 |
| 112. Hexachlorocyclopentadiene | 1,2,4,5-tetrachlorobenzene | 62-86 | 0.008 | 3.01 | 0.025 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 0.017 | 3.01 | 0.050 |

1 For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-9

CALCULATION OF PROPOSED WASTEWATER TREATMENT STANDARDS FOR K018

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| **Volatiles (8240) (Total Concentration)** | | | | | |
| 12.  Chloroethane | Chloroform | 4,600-6,000 | 0.005 | 3.01 | 0.014 |
| 15.  Chloromethane | Chloroform | 4,600-6,000 | 0.005 | 3.01 | 0.014 |
| 22.  1,1-Dichloroethane | Chloroform | 4,600-6,000 | 0.005 | 3.01 | 0.014 |
| 23.  1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 0.005 | 3.01 | 0.014 |
| 45.  1,1,1-Trichloroethane | Carbon tetrachloride | 3,500-4,100 | 0.005 | 3.01 | 0.014 |
| **Semivolatiles (8270) (Total Concentration)** | | | | | |
| 110.  Hexachlorobenzene | Hexachlorobenzene | 60-87 | 0.017 | 3.01 | 0.050 |
| 111.  Hexachlorobutadiene | Naphthalene | 314-470 | 0.003 | 3.01 | 0.010 |
| 137.  Pentachloroethane | p-Dichlorobenzene | 74-90 | 0.003 | 3.01 | 0.009 |

1For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been roundedd to show significant figures only.

Table 6-10

CALCULATION OF PROPOSED WASTEWATER TREATMENT STANDARDS FOR K019

| Regulated Constituent (SW-846 Method Number)[1] | Untreated K019 at Plant A* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | |
| 7.   Carbon tetrachloride | 3,500-4,100 | 0.005 | 3.01 | 0.014 |
| 14.  Chloroform | 4,600-6,000 | 0.005 | 3.01 | 0.014 |
| 23.  1,2-Dichloroethane | 87,000-122,000 | 0.005 | 3.01 | 0.014 |
| 42.  Tetrachloroethene | 6,000-78,000 | 0.005 | 3.01 | 0.014 |
| 46.  1,1,2-Trichloroethane | 33,000-81,000 | 0.005 | 3.01 | 0.014 |
| Semivolatiles (8270) (Total Concentration) | | | | |
| 68.  Bis(2-chloroethyl)ether | 280-340 | 0.003 | 3.01 | 0.010 |
| 88.  p-Dichlorobenzene | 74-90 | 0.003 | 3.01 | 0.009 |
| 110. Hexachlorobenzene | 60-87 | 0.017 | 3.01 | 0.050 |
| 113. Hexachloroethane | 85-120 | 0.017 | 3.01 | 0.050 |
| 121. Naphthalene | 314-470 | 0.003 | 3.01 | 0.010 |
| 136. Pentachlorobenzene | 51-65 | 0.017 | 3.01 | 0.050 |
| 148. 1,2,4,5-Tetrachlorobenzene | 62-86 | 0.008 | 3.01 | 0.025 |
| 150. 1,2,4-Trichlorobenzene | 65-100 | 0.008 | 3.01 | 0.025 |

1 For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*Concentration values for the untreated waste have not been corrected for recovery.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-11

CALCULATION OF PROPOSED WASTEWATER TREATMENT STANDARDS FOR K020

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 23. 1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 0.005 | 3.01 | 0.014 |
| 41. 1,1,2,2-Tetrachloroethane | p-Dichlorobenzene | 74-90 | 0.003 | 3.01 | 0.009 |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.005 | 3.01 | 0.014 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 0.017 | 3.01 | 0.050 |
| 137. Pentachloroethane | p-Dichlorobenzene | 74-90 | 0.003 | 3.01 | 0.090 |

Semivolatiles (8270)
(Total Concentrations)

No semivolatile organics were proposed for regulation for this waste code.

1For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-12

CALCULATION OF PROPOSED WASTEWATER TREATMENT STANDARDS FOR K030

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |
| Semivolatiles (8270) (Total Concentration | | | | | |
| 111. Hexachlorobutadiene | Naphthalene | 314-470 | 0.003 | 3.01 | 0.010 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 0.017 | 3.01 | 0.050 |
| 115. Hexachloropropene | 1,2,4-Trichlorobenzene | 65-100 | 0.008 | 3.01 | 0.025 |
| 137. Pentachloroethane | p-Dichlorobenzene | 74-90 | 0.003 | 3.01 | 0.009 |
| 148. 1,2,4,5-Tetrachlorobenzene | 1,2,4,5-Tetrachlorobenzene | 62-86 | 0.008 | 3.01 | 0.025 |
| 150. 1,2,4-Trichlorobenzene | 1,2,4-Trichlorobenzene | 65-100 | 0.008 | 3.01 | 0.025 |

1For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

6-29

Table 6-13

CORRECTED TOTAL COMPOSITION DATA FOR ORGANICS
IN ROTARY KILN SCRUBBER WATER FROM TREATMENT OF K019

| Constituent* | Corrected Concentration in the Treated Waste, ppm | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Volatiles | | | | | | |
| 9. Chlorobenzene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 14. Chloroform | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 22. 1,1-Dichloroethane | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 23. 1,2-Dichloroethane | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 42. Tetrachloroethene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 45. 1,1,1-Trichloroethane | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Semivolatiles | | | | | | |
| 68. Bis(2-chloroethyl)ether | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 88. p-Dichlorobenzene | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 109. Fluorene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 110. Hexachlorobenzene | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 113. Hexachloroethane | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 121. Naphthalene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 141. Phenanthrene | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 148. 1,2,4,5-Tetrachlorobenzene | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| 150. 1,2,4-Trichlorobenzene | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

*Constituents proposed for regulation and present in untreated K019.

Table 6-14

CALCULATION OF WASTEWATER TREATMENT STANDARDS FOR K016
BY METHOD TO BE CONSIDERED FOR THE FINAL RULE

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |
| Semivolatiles (8270) (Total Concentration | | | | | |
| 110. Hexachlorobenzene | Hexachlorobenzene | 60-87 | 0.012 | 2.8 | 0.033 |
| 111. Hexachlorobutadiene | Bis(2-chloroethyl)ether | 280-340 | 0.002 | 2.8 | 0.007 |
| 112. Hexachlorocyclopentadiene | Bis(2-chloroethyl)ether | 280-340 | 0.002 | 2.8 | 0.007 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 0.012 | 2.8 | 0.033 |

1 For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-15

CALCULATION OF WASTEWATER TREATMENT STANDARDS FOR K018
BY METHOD TO BE CONSIDERED FOR THE FINAL RULE

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| **Volatiles (8240) (Total Concentration)** | | | | | |
| 12. Chloroethane | Bis(2-chloroethyl)ether | 280-340 | 0.002 | 2.8 | 0.007 |
| 15. Chloromethane | Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |
| 22. 1,1-Dichloroethane | 1,1-Dichloroethane | <2,000-2,200 | 0.003 | 2.8 | 0.007 |
| 23. 1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 0.003 | 2.8 | 0.007 |
| 45. 1,1,1-Trichloroethane | 1,1,1-Trichloroethane | 2,200-3,210 | 0.003 | 2.8 | 0.007 |
| **Semivolatiles (8270) (Total Concentration)** | | | | | |
| 110. Hexachlorobenzene | Hexachlorobenzene | 60-87 | 0.012 | 2.8 | 0.033 |
| 111. Hexachlorobutadiene | Bis(2-chloroethyl)ether | 280-3,400 | 0.002 | 2.8 | 0.007 |
| 137. Pentachloroethane | 1,1,1-Trichloroethane | 2,200-3,210 | 0.003 | 2.8 | 0.007 |

[1]For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-16

CALCULATION OF WASTEWATER TREATMENT STANDARDS FOR K019
BY METHOD TO BE CONSIDERED FOR THE FINAL RULE

| Regulated Constituent (SW-846 Method Number)[1] | Untreated K019 at Plant A* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | |
| 9. Chlorobenzene | <2,000-3,000 | 0.002 | 2.8 | 0.006 |
| 14. Chloroform | 4,600-6,000 | 0.003 | 2.8 | 0.007 |
| 23. 1,2-Dichloroethane | 87,000-122,000 | 0.003 | 2.8 | 0.007 |
| 42. Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |
| 45. 1,1,1-Trichloroethane | 2,200-3,210 | 0.003 | 2.8 | 0.007 |
| Semivolatiles (8270) (Total Concentration) | | | | |
| 68. Bis(2-chloroethyl)ether | 280-340 | 0.002 | 2.8 | 0.007 |
| 88. p-Dichlorobenzene | 74-90 | 0.003 | 2.8 | 0.008 |
| 109. Fluorene | 16-22 | 0.002 | 2.8 | 0.007 |
| 113. Hexachloroethane | 85-120 | 0.012 | 2.8 | 0.033 |
| 121. Naphthalene | 314-470 | 0.002 | 2.8 | 0.007 |
| 141. Phenanthrene | 11-21 | 0.002 | 2.8 | 0.007 |
| 148. 1,2,4,5-Tetrachlorobenzene | 62-86 | 0.006 | 2.8 | 0.017 |
| 150. 1,2,4-Trichlorobenzene | 65-100 | 0.008 | 2.8 | 0.023 |

1 For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*Concentration values for the untreated waste have not been corrected for recovery.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-17

CALCULATION OF WASTEWATER TREATMENT STANDARDS FOR K020
BY METHOD TO BE CONSIDERED FOR THE FINAL RULE

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 23. 1,2-Dichloroethane | 1,2-Dichloroethane | 87,000-122,000 | 0.003 | 2.8 | 0.007 |
| 41. 1,1,2,2-Tetrachloroethane | 1,1,1-Trichloroethane | 2,200-3,210 | 0.003 | 2.8 | 0.007 |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |

Semivolatiles (8270)
Total Concentrations

No semivolatile organics were proposed for regulation for this waste code.

1For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

Table 6-18

CALCULATION OF WASTEWATER TREATMENT STANDARDS FOR K030
BY METHOD TO BE CONSIDERED FOR THE FINAL RULE

| Regulated Constituent (SW-846 Method Number)[1] | K019 Constituent From Which Treatment Data Were Transferred | Untreated Concentration* (ppm) | Arithmetic Average of Corrected Treatment Values** (ppm) | Variability Factor (VF) | Treatment Standard** (Average x VF)(ppm) |
|---|---|---|---|---|---|
| Volatiles (8240) (Total Concentration) | | | | | |
| 42. Tetrachloroethene | Tetrachloroethene | 6,000-78,000 | 0.003 | 2.8 | 0.007 |
| Semivolatiles (8270) (Total Concentration) | | | | | |
| 87. o-Dichlorobenzene | p-Dichlorobenzene | 74-90 | 0.003 | 2.8 | 0.008 |
| 88. p-Dichlorobenzene | p-Dichlorobenzene | 74-90 | 0.003 | 2.8 | 0.008 |
| 111. Hexachlorobutadiene | Bis(2-chloroethyl)ether | 280-340 | 0.002 | 2.8 | 0.007 |
| 113. Hexachloroethane | Hexachloroethane | 85-120 | 0.012 | 2.8 | 0.033 |
| 137. Pentachloroethane | 1,1,1-Trichloroethane | 2,200-3,210 | 0.003 | 2.8 | 0.007 |
| 148. 1,2,4,5-Tetrachlorobenzene | 1,2,4,5-Tetrachlorobenzene | 62-86 | 0.006 | 2.8 | 0.017 |
| 150. 1,2,4-Trichlorobenzene | 1,2,4-Trichlorobenzene | 65-100 | 0.008 | 2.8 | 0.023 |

1For detailed discussion of the analytical methods upon which these treatment standards are based, see Appendix D (QA/QC section).

*This is the untreated concentration in K019 of each constituent from which treatment data were transferred.

**The values shown on this table for arithmetic averages and treatment standards have been rounded to show significant figures only.

7.0    CONCLUSIONS


The Agency has proposed treatment standards for five chlorinated

organic waste codes (K016, K018, K019, K020 and K030.)  Standards for

nonwastewater forms of these wastes are presented in Table 7-1 and standards

for wastewater forms of these wastes are presented in Table 7-2.


The treatment standards proposed for K016, K018, K019, K020 and K030

have been developed consistent with EPA's promulgated methodology for BDAT

(November 7, 1986, 51 FR 40572).  These five listed wastes are generated in

the production of chlorinated organic chemicals.  The Agency estimates that

there are 47 plants that may produce the listed wastes.


Based on a careful review of the industry processes which generate

these wastes and all available data characterizing these wastes, the Agency

has determined that these listed wastes (K016, K018, K019, K020 and K030)

represent a single waste treatability group.  Wastes in this treatability

group are primarily comprised of mono- and poly-chlorinated aliphatic and

aromatic compounds.  Although the concentrations of specific constituents will

vary from facility to facility, all of the listed wastes are expected to

contain similar BDAT organics and are expected to be treatable to the same

levels using the same technology.  The BDAT List constituents generally

present in wastes of this treatability group are chlorobenzene, chloroethane,

chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1,2,2-tetrachloroethane,

tetrachloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane,

bis(2-chloroethyl)ether, hexachlorobenzene, hexachlorobutadiene, hexachloro-
cyclopentadiene, hexachloroethane, hexachloropropene, naphthalene, pentachlor-
obenzene, pentachloroethane, phenanthrene, 1,2,4,5-tetrachlorobenzene, and
1,2,4-trichlorobenzene. EPA has examined the sources of the wastes,
applicable and demonstrated technologies, and attainable treatment performance
in order to support a single regulatory approach for these five listed
chlorinated wastes.

The Agency has identified the following demonstrated and available
technologies for treatment of BDAT List organic constituents present in the
wastes which are part of this treatability group: incineration technologies
including rotary kiln and liquid injection incineration; and total recycle or
reuse. The Agency has treatment performance data for rotary kiln incineration
of waste code K019 at plant A; no other treatment performance data are
available for these waste codes. Rotary kiln incineration is determined to be
the best demonstrated and available technology (BDAT) for treatment of K019
based on the treatment performance data available to the Agency. EPA has
determined that the chlorinated waste group K016, K018, K019, K020, and K030
represent a waste treatability group. Therefore, since rotary kiln
incineration has been determined to be BDAT for K019, this technology is also
BDAT for K016, K018, K020, and K030.

Regulated constituents for K016, K018, K019, K020, and K030 were
selected based on a careful evaluation of the BDAT List constituents detected
at treatable levels in the untreated or treated wastes and the waste

characteristics that would affect performance of incineration, i.e., boiling point or bond dissociation energy. Boiling point of a constituent is determined as the waste characteristic that would affect performance of incineration with respect to the kiln ash residue. Bond dissociation energy of a constituent is determined as the waste characteristic that would affect performance of incineration with respect to the scrubber water residual.

BDAT List constituents that were detected in the untreated waste, but were not treated by BDAT, were not selected for regulation. For example, BDAT List metals were considered but were not selected in K019 because these constituents were not detected at treatable levels in the wastes, are not effectively treated by rotary kiln incineration (BDAT). Some BDAT List organic constituents were considered for regulation but were not selected for regulation because these constituents were believed to be adequately controlled by regulation of other constituents. This decision was based on a comparison of the waste characteristics that would affect performance (boiling point or bond dissociation energy) of those constituents considered for regulation. For instance, carbon tetrachloride (boiling point 77$^{\circ}$C) was considered for regulation in K019 wastewater but was not selected for regulation because this constituent was found at a lower level in the untreated waste and it is believed to be adequately controlled by regulation of chlorobenzene (boiling point 131$^{\circ}$C), 1,2-dichloroethane (boiling point 83$^{\circ}$C). Some BDAT List organic constituents, considered for regulation, were not detected in the untreated waste but were detected in the treated waste. However, these constituents were found at treatable levels in other

wastes treated at the same time as the untreated waste of concern; therefore, these constituents were not selected for regulation. For instance, bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were not detected in the untreated K019 but were detected in the kiln ash residue. These constituents were also found at treatable levels in another waste which was incinerated simultaneously with untreated K019; therefore, these constituents were not selected for regulation in K019 nonwastewater.

In the development of BDAT treatment standards for regulated constituents in these chlorinated organic listed wastes, the Agency examined all available treatment performance data. The Agency conducted tests on a full scale rotary kiln incinerator treating K019. Design and operating data collected during the testing of this technology indicate that the technology was properly operated during each sample set; accordingly, all of the treatment performance data collected during the tests were used in the development of the BDAT treatment standards. BDAT treatment standards for K019 were derived from analytical data that have been adjusted to take into account analytical interference associated with the chemical make-up of the sample. Subsequently, the mean of the adjusted concentration was multiplied by a variability factor to derive the BDAT treatment standard. The variability factor represents the variability inherent in the treatment process and sampling and analytical methods. Variability factors were determined by statistically calculating the variability seen for a number of data points for a given constituent. For constituents for which specific variability factors could not be calculated, a variability factor of 2.8 was used.

Rotary kiln incineration generally results in the generation of two treatment residuals:  kiln ash (nonwastewater) and scrubber water (wastewater).  (For the purpose of the land disposal restrictions rule, wastewaters are defined as wastes containing less than or equal to 1% (weight basis) filterable solids and less than or equal to 1% (weight basis) total organic carbon.)  Two categories of treatment standards were developed for the K016, K018, K019, K020 and K030 treatability group:  wastewater and nonwastewater. Nonwastewater and wastewater BDAT treatment standards for K019 are based on the treatment performance data from EPA's test of rotary kiln incineration.

Treatment performance data were not available from rotary kiln incineration of waste codes K016, K018, K020, and K030.  Therefore, treatment performance data were transferred from K019 to K016, K018, K020, and K030. Nonwastewater BDAT treatment standards for K016, K018, K020, and K030 are derived from the transfer of treatment performance (kiln ash residue) data from waste code K019.  This transfer is based on boiling points.  Wastewater BDAT treatment standards for K016, K018, K020, and K030 are derived from the transfer of treatment performance (scrubber water) data from waste code K019.

Wastes determined to be K016, K018, K019, K020 and K030 wastes may be land disposed if they meet the standards at the point of disposal.  The BDAT technology upon which the treatment standards are based (rotary kiln incineration) need not be specifically utilized prior to land disposal, provided that an alternate technology utilized achieves the standards.

These standards become effective no later than August 8, 1988, as described in the schedule set forth in 40 CFR 268.10. Due to the lack of nationwide incineration capacity at this time, the Agency has proposed to grant a 2-year nationwide variance to the effective date of the land disposal restriction for these wastes. A detailed discussion of the Agency's determination that a lack of nationwide incineration capacity exists is presented in the Capacity Background Document which is available in the Administrative Record of this rule.

Table 7-1

BDAT TREATMENT STANDARDS
FOR
NONWASTEWATER K016, K018, K019, K020, AND K030

| Regulated Organic Constituents | Total Concentration (mg/kg) | | | | |
| | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 9. Chlorobenzene | NA | NA | 5.66 | NA | NA |
| 12. Chloroethane | NA | 5.96 | NA | NA | NA |
| 14. Chloroform | NA | NA | 5.96 | NA | NA |
| 22. 1,1-Dichloroethane | NA | 5.96 | NA | NA | NA |
| 23. 1,2-Dichloroethane | NA | 5.96 | 5.96 | 5.96 | NA |
| 41. 1,1,2,2-Tetrachloroethane | NA | NA | NA | 5.44 | NA |
| 42. Tetrachloroethene | 5.96 | NA | 5.96 | 5.96 | 5.96 |
| 45. 1,1,1-Trichloroethane | NA | 5.96 | 5.96 | NA | NA |
| 68. Bis(2-chloroethyl)ether | NA | NA | 5.44 | NA | NA |
| 110. Hexachlorobenzene | 27.2 | 27.2 | NA | NA | NA |
| 111. Hexachlorobutadiene | 5.44 | 5.44 | NA | NA | 5.44 |
| 112. Hexachlorocyclopentadiene | 5.44 | NA | NA | NA | NA |
| 113. Hexachloroethane | 27.2 | 27.2 | 27.2 | NA | 27.2 |
| 115. Hexachloropropene | NA | NA | NA | NA | 18.7 |
| 121. Naphthalene | NA | NA | 5.44 | NA | NA |
| 136. Pentachlorobenzene | NA | NA | NA | NA | 27.2 |
| 137. Pentachloroethane | NA | 5.44 | NA | NA | 5.44 |
| 141. Phenanthrene | NA | NA | 5.44 | NA | NA |
| 148. 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | 13.6 |
| 150. 1,2,4-Trichlorobenzene | NA | NA | 18.7 | NA | 18.7 |

NA - Not applicable. This constituent is not being proposed for regulation for this waste.

Table 7-2

BDAT TREATMENT STANDARDS FOR
WASTEWATER K016, K018, K019, K020, AND K030

| Regulated Organic Constituents | Total Concentration (mg/L) | | | | |
| | K016 | K018 | K019 | K020 | K030 |
|---|---|---|---|---|---|
| 7. Carbon Tetrachloride | NA | NA | 0.014 | NA | NA |
| 12. Chloroethane | NA | 0.014 | NA | NA | NA |
| 14. Chloroform | NA | NA | 0.014 | NA | NA |
| 15. Chloromethane | NA | 0.014 | NA | NA | NA |
| 22. 1,1-Dichloroethane | NA | 0.014 | NA | NA | NA |
| 23. 1,2-Dichloroethane | NA | 0.014 | 0.014 | 0.014 | NA |
| 41. 1,1,2,2-Tetrachloroethane | NA | NA | NA | 0.009 | NA |
| 42. Tetrachloroethene | 0.014 | NA | 0.014 | 0.014 | 0.014 |
| 45. 1,1,1-Trichloroethane | NA | 0.014 | NA | NA | NA |
| 46. 1,1,2-Trichloroethane | NA | NA | 0.014 | NA | NA |
| 68. Bis(2-chloroethyl)ether | NA | NA | 0.010 | NA | NA |
| 88. p-Dichlorobenzene | NA | NA | 0.009 | NA | NA |
| 110. Hexachlorobenzene | 0.050 | 0.050 | 0.050 | NA | NA |
| 111. Hexachlorobutadiene | 0.010 | 0.010 | NA | NA | 0.010 |
| 112. Hexachlorocyclopentadiene | 0.025 | NA | NA | NA | NA |
| 113. Hexachloroethane | 0.050 | NA | 0.050 | 0.050 | 0.050 |
| 115. Hexachloropropene | NA | NA | NA | NA | 0.025 |
| 121. Naphthalene | NA | NA | 0.010 | NA | NA |
| 136. Pentachlorobenzene | NA | NA | 0.050 | NA | NA |
| 137. Pentachloroethane | NA | 0.009 | NA | 0.009 | 0.009 |
| 148. 1,2,4,5-Tetrachlorobenzene | NA | NA | 0.025 | NA | 0.025 |
| 150. 1,2,4-Trichlorobenzene | NA | NA | 0.025 | NA | 0.025 |

NA - Not Applicable. This constituent is not being proposed for regulation for this waste.

7-8

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# APPENDIX A

## STATISTICAL METHODS

A.1  F Value Determination for ANOVA Test

A.2  Variability Factor

## A.1 F Value Determination for ANOVA Test

As noted earlier in Section 1.0, EPA is using the statistical method known as analysis of variance in the determination of the level of performance that represents "best" treatment where more than one technology is demonstrated. This method provides a measure of the differences between data sets. If the differences are not statistically significant, the data sets are said to be homogeneous.

If the Agency found that the levels of performance for one or more technologies are not statistically different (i.e., the data sets are homogeneous), EPA would average the long term performance values achieved by each technology and then multiply this value by the largest variability factor associated with any of the acceptable technologies. If EPA found that one technology performs significantly better (i.e., the data sets are not homogeneous), BDAT would be the level of performance achieved by the best technology multiplied by its variability factor.

To determine whether any or all of the treatment performance data sets are homogeneous using the analysis of variance method, it is necessary to compare a calculated "F value" to what is known as a "critical value." (See Table A-1.) These critical values are available in most statistics texts (see, for example, Statistical Concepts and Methods by Bhattacharyya and Johnson, 1977, John Wiley Publications, New York).

Where the F value is less than the critical value, all treatment data sets are homogeneous. If the F value exceeds the critical value, it is

necessary to perform a "pair wise F" test to determine if any of the sets are homogeneous. The "pair wise F" test must be done for all of the various combinations of data sets using the same method and equation as the general F test.

The F value is calculated as follows:

(i)   All data are natural logtransformed.

(ii)   The sum of the data points for each data set is computed ($T_i$).

(iii)   The statistical parameter known as the sum of the squares between data sets (SSB) is computed:

$$SSB = \left[ \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right) \right] - \left( \left[ \frac{\sum_{i=1}^{k} T_i}{N} \right]^2 \right)$$

where:

$k$ = number of treatment technologies
$n_i$ = number of data points for technology i
$N$ = number of data points for all technologies
$T_i$ = sum of natural logtransformed data points for each technology.

(iv)   The sum of the squares within data sets (SSW) is computed:

$$SSW = \left[ \sum_{i=1}^{k} \sum_{j=1}^{n_i} x^2_{i,j} \right] - \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right)$$

where:

$x_{i,j}$ = the natural logtransformed observations (j) for treatment technology (i).

(v)   The degrees of freedom corresponding to SSB and SSW are calculated. For SSB, the degree of freedom is given by k-1. For SSW, the degree of freedom is given by N-k.

(vi) Using the above parameters, the F value is calculated as follows:

$$F = \frac{MSB}{MSW}$$

where:

MSB = SSB/(k-1) and
MSW = SSW/(N-k).

A computational table summarizing the above parameters is shown below.

Computational Table for the F Value

| Source | Degrees of freedom | Sum of squares | Mean square | F |
|---|---|---|---|---|
| Between | K-1 | SSB | MSB = SSB/k-1 | MSB/MSW |
| Within | N-k | SSW | MSW = SSW/N-k | |

Below are three examples of the ANOVA calculation. The first two represent treatment by different technologies that achieve statistically similar treatment; the last example represents a case where one technology achieves significantly better treatment than the other technology.

# Table A-1

## F Distribution at the 95 Percent Confidence Level

$F_{0.95}$

| Denominator degrees of freedom | Numerator degrees of freedom | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 161 4 | 199 5 | 215 7 | 224 6 | 230 2 | 234 0 | 236 8 | 238 9 | 240 5 |
| 2 | 18 51 | 19 00 | 19 16 | 19 25 | 19 30 | 19 33 | 19 35 | 19 37 | 19 38 |
| 3 | 10 13 | 9 55 | 9 28 | 9 12 | 9 01 | 8 94 | 8 89 | 8 85 | 8 81 |
| 4 | 7 71 | 6 94 | 6 59 | 6 39 | 6 26 | 6 16 | 6 09 | 6.04 | 6 00 |
| 5 | 6 61 | 5 79 | 5.41 | 5.19 | 5.05 | 4 95 | 4 88 | 4 82 | 4 77 |
| 6 | 5 99 | 5 14 | 4 76 | 4 53 | 4 39 | 4 28 | 4 21 | 4 15 | 4 10 |
| 7 | 5 59 | 4 74 | 4 35 | 4 12 | 3 97 | 3.87 | 3.79 | 3.73 | 3 68 |
| 8 | 5 32 | 4 46 | 4 07 | 3 84 | 3.69 | 3.58 | 3.50 | 3.44 | 3 39 |
| 9 | 5.12 | 4 26 | 3 86 | 3 63 | 3.48 | 3 37 | 3 29 | 3.23 | 3 18 |
| 10 | 4 96 | 4 10 | 3 71 | 3 48 | 3.33 | 3 22 | 3.14 | 3.07 | 3.02 |
| 11 | 4 84 | 3 98 | 3 59 | 3.36 | 3.20 | 3.09 | 3.01 | 2.95 | 2.90 |
| 12 | 4 75 | 3 89 | 3 49 | 3.26 | 3.11 | 3.00 | 2.91 | 2.85 | 2 80 |
| 13 | 4 67 | 3 81 | 3 41 | 3.18 | 3 03 | 2.92 | 2.83 | 2.77 | 2 71 |
| 14 | 4 60 | 3 74 | 3 34 | 3 11 | 2 96 | 2.85 | 2.76 | 2.70 | 2 65 |
| 15 | 4 54 | 3 68 | 3 29 | 3 06 | 2 90 | 2.79 | 2 71 | 2.64 | 2 59 |
| 16 | 4 49 | 3 63 | 3 24 | 3 01 | 2 85 | 2.74 | 2 66 | 2.59 | 2 54 |
| 17 | 4 45 | 3 59 | 3 20 | 2 96 | 2 81 | 2.70 | 2.61 | 2 55 | 2 49 |
| 18 | 4 41 | 3 55 | 3 16 | 2 93 | 2.77 | 2 66 | 2.58 | 2 51 | 2 46 |
| 19 | 4 38 | 3 52 | 3 13 | 2 90 | 2 74 | 2 63 | 2.54 | 2.48 | 2 42 |
| 20 | 4 35 | 3 49 | 3 10 | 2 87 | 2 71 | 2 60 | 2.51 | 2.45 | 2 39 |
| 21 | 4 32 | 3 47 | 3 07 | 2 84 | 2 68 | 2.57 | 2 49 | 2 42 | 2 37 |
| 22 | 4 30 | 3 44 | 3 05 | 2 82 | 2 66 | 2 55 | 2.46 | 2.40 | 2 34 |
| 23 | 4 28 | 3 42 | 3 03 | 2 80 | 2.64 | 2 53 | 2 44 | 2.37 | 2 32 |
| 24 | 4 26 | 3 40 | 3 01 | 2 78 | 2 62 | 2 51 | 2 42 | 2.36 | 2.30 |
| 25 | 4 24 | 3 39 | 2 99 | 2 76 | 2 60 | 2 49 | 2 40 | 2.34 | 2 28 |
| 26 | 4 23 | 3 37 | 2 98 | 2 74 | 2 59 | 2 47 | 2.39 | 2 32 | 2 27 |
| 27 | 4 21 | 3 35 | 2 96 | 2.73 | 2 57 | 2 46 | 2.37 | 2 31 | 2.25 |
| 28 | 4 20 | 3 34 | 2 95 | 2 71 | 2 56 | 2 45 | 2.36 | 2 29 | 2.24 |
| 29 | 4 18 | 3 33 | 2.93 | 2.70 | 2 55 | 2.43 | 2.35 | 2.28 | 2.22 |
| 30 | 4 17 | 3 32 | 2 92 | 2 69 | 2 53 | 2.42 | 2.33 | 2.27 | 2 21 |
| 40 | 4 08 | 3 23 | 2 84 | 2 61 | 2 45 | 2.34 | 2 25 | 2.18 | 2 12 |
| 60 | 4 00 | 3 15 | 2.76 | 2 53 | 2 37 | 2 25 | 2.17 | 2.10 | 2 04 |
| 120 | 3 92 | 3 07 | 2.68 | 2.45 | 2 29 | 2.17 | 2.09 | 2.02 | 1 96 |
| ∞ | 3.84 | 3.00 | 2.60 | 2 37 | 2.21 | 2.10 | 2.01 | 1 94 | 1 88 |

Example 1
Methylene Chloride

| | Steam stripping | | | | Biological treatment | | |
|---|---|---|---|---|---|---|---|
| Influent ($\mu$g/l) | Effluent ($\mu$g/l) | ln(effluent) | $[\ln(\text{effluent})]^2$ | Influent ($\mu$g/l) | Effluent ($\mu$g/l) | ln(effluent) | $[\ln(\text{effluent})]^2$ |
| 1550.00 | 10.00 | 2.30 | 5.29 | 1960.00 | 10.00 | 2.30 | 5.29 |
| 1290.00 | 10.00 | 2.30 | 5.29 | 2568.00 | 10.00 | 2.30 | 5.29 |
| 1640.00 | 10.00 | 2.30 | 5.29 | 1817.00 | 10.00 | 2.30 | 5.29 |
| 5100.00 | 12.00 | 2.48 | 6.15 | 1640.00 | 26.00 | 3.26 | 10.63 |
| 1450.00 | 10.00 | 2.30 | 5.29 | 3907.00 | 10.00 | 2.30 | 5.29 |
| 4600.00 | 10.00 | 2.30 | 5.29 | | | | |
| 1760.00 | 10.00 | 2.30 | 5.29 | | | | |
| 2400.00 | 10.00 | 2.30 | 5.29 | | | | |
| 4800.00 | 10.00 | 2.30 | 5.29 | | | | |
| 12100.00 | 10.00 | 2.30 | 5.29 | | | | |

Sum:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| - | - | 23.18 | 53.76 | - | - | 12.46 | 31.79 |

Sample Size:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | 10 | 10 | - | 5 | 5 | 5 | - |

Mean:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3669 | 10.2 | 2.32 | - | 2378 | 13.2 | 2.49 | - |

Standard Deviation:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3328.67 | .63 | .06 | - | 923.04 | 7.15 | .43 | - |

Variability Factor:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1.15 | - | - | - | 2.48 | - | - |

ANOVA Calculations:

$$SSB = \left[ \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right) \right] - \left( \frac{\left[ \sum_{i=1}^{k} T_i \right]^2}{N} \right)$$

$$SSW = \left[ \sum_{i=1}^{k} \sum_{j=1}^{n_i} x^2_{i,j} \right] - \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right)$$

MSB = SSB/(k-1)

MSW = SSW/(N-k)

Example 1   (continued)

F   = MSB/MSW

where:

k   = number of treatment technologies

$n_i$ = number of data points for technology i

N   = number of natural log transformed data points for all technologies

$T_i$ = sum of log transformed data points for each technology

$X_{ij}$ = the nat. log transformed observations (j) for treatment technology (i)

$n_1 = 10$, $n_2 = 5$, $N = 15$, $k = 2$, $T_1 = 23.18$, $T_2 = 12.46$, $T = 35.64$, $T^2 = 1270.21$

$T_1^2 = 537.31$   $T_2^2 = 155.25$

$$SSB = \left[ \frac{537.31}{10} + \frac{155.25}{5} \right] - \frac{1270.21}{15} = 0.10$$

$$SSW = (53.76 + 31.79) - \left[ \frac{537.31}{10} + \frac{155.25}{5} \right] = 0.77$$

MSB = 0.10/1 = 0.10

MSW = 0.77/13 = 0.06

$$F = \frac{0.10}{0.06} = 1.67$$

ANOVA Table

| Source | Degrees of freedom | SS | MS | F |
|--------|--------------------|-----|-----|-----|
| Between(B) | 1 | 0.10 | 0.10 | 1.67 |
| Within(W) | 13 | 0.77 | 0.06 | |

The critical value of the F test at the 0.05 significance level is 4.67. Since the F value is less than the critical value, the means are not significantly different (i.e., they are homogeneous).

Note:  All calculations were rounded to two decimal places.  Results may differ depending upon the number of decimal places used in each step of the calculations.

Example 2
Trichloroethylene

| | Steam stripping | | | | Biological treatment | | |
| Influent (μg/l) | Effluent (μg/l) | ln(effluent) | [ln(effluent)]$^2$ | Influent (μg/l) | Effluent (μg/l) | ln(effluent) | [ln(effluent)]$^2$ |
|---|---|---|---|---|---|---|---|
| 1650.00 | 10.00 | 2.30 | 5.29 | 200.00 | 10.00 | 2.30 | 5.29 |
| 5200.00 | 10.00 | 2.30 | 5.29 | 224.00 | 10.00 | 2.30 | 5.29 |
| 5000.00 | 10.00 | 2.30 | 5.29 | 134.00 | 10.00 | 2.30 | 5.29 |
| 1720.00 | 10.00 | 2.30 | 5.29 | 150.00 | 10.00 | 2.30 | 5.29 |
| 1560.00 | 10.00 | 2.30 | 5.29 | 484.00 | 16.25 | 2.79 | 7.78 |
| 10300.00 | 10.00 | 2.30 | 5.29 | 163.00 | 10.00 | 2.30 | 5.29 |
| 210.00 | 10.00 | 2.30 | 5.29 | 182.00 | 10.00 | 2.30 | 5.29 |
| 1600.00 | 27.00 | 3.30 | 10.89 | | | | |
| 204.00 | 85.00 | 4.44 | 19.71 | | | | |
| 160.00 | 10.00 | 2.30 | 5.29 | | | | |

**Sum:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| - | - | 26.14 | 72.92 | - | - | 16.59 | 39.52 |

**Sample Size:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | 10 | 10 | - | 7 | 7 | 7 | - |

**Mean:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2760 | 19.2 | 2.61 | - | 220 | 10.89 | 2.37 | - |

**Standard Deviation:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3209.6 | 23.7 | .71 | - | 120.5 | 2.36 | .19 | - |

**Variability Factor:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| - | 3.70 | - | - | - | 1.53 | - | - |

ANOVA Calculations:

$$SSB = \left[ \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right) \right] - \left( \frac{\left[ \sum_{i=1}^{k} T_i \right]^2}{N} \right)$$

$$SSW = \left[ \sum_{i=1}^{k} \sum_{j=1}^{n_i} x^2_{i,j} \right] - \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right)$$

$$MSB = SSB/(k-1)$$

$$MSW = SSW/(N-k)$$

Example 2  (continued)

F   = MSB/MSW

where:

k   = number of treatment technologies

$n_i$   = number of data points for technology i

N   = number of data points for all technologies

$T_i$   = sum of natural log transformed data points for each technology

$X_{ij}$ = the natural log transformed observations (j) for treatment technology (i)

$N_1$ = 10,  $N_2$ = 7,  N = 17,  k = 2,  $T_1$ = 26.14,  $T_2$ = 16.59,  T = 42.73,  $T^2$ = 1825.85,  $T_1^2$ = 683.30,

$T_2^2$ = 275.23

$$SSB = \left( \frac{683.30}{10} + \frac{275.23}{7} \right) - \frac{1825.85}{17} \qquad = 0.25$$

$$SSW = (72.92 + 39.52) - \left( \frac{683.30}{10} + \frac{275.23}{7} \right) \qquad = 4.79$$

MSB = 0.25/1 = 0.25

MSW = 4.79/15 = 0.32

$$F = \frac{0.25}{0.32} = 0.78$$

## ANOVA Table

| Source | Degrees of freedom | SS | MS | F |
|--------|--------------------|-----|------|------|
| Between(B) | 1 | 0.25 | 0.25 | 0.78 |
| Within(W) | 15 | 4.79 | 0.32 | |

The critical value of the F test at the 0.05 significance level is 4.54.  Since the F value is less than the critical value, the means are not significantly different (i.e., they are homogeneous).

Note:  All calculations were rounded to two decimal places.  Results may differ depending upon the number of decimal places used in each step of the calculations.

Example 3
Chlorobenzene

| Activated sludge followed by carbon adsorption | | | | Biological treatment | | | |
|---|---|---|---|---|---|---|---|
| Influent (μg/1) | Effluent (μg/1) | ln(effluent) | [ln(effluent)]$^2$ | Influent (μg/1) | Effluent (μg/1) | ln(effluent) | ln[(effluent)]$^2$ |
| 7200.00 | 80.00 | 4.38 | 19.18 | 9206.00 | 1083.00 | 6.99 | 48.86 |
| 6500.00 | 70.00 | 4.25 | 18.06 | 16646.00 | 709.50 | 6.56 | 43.03 |
| 6075.00 | 35.00 | 3.56 | 12.67 | 49775.00 | 460.00 | 6.13 | 37.58 |
| 3040.00 | 10.00 | 2.30 | 5.29 | 14731.00 | 142.00 | 4.96 | 24.60 |
| | | | | 3159.00 | 603.00 | 6.40 | 40.96 |
| | | | | 6756.00 | 153.00 | 5.03 | 25.30 |
| | | | | 3040.00 | 17.00 | 2.83 | 8.01 |

Sum:

| - | - | 14.49 | 55.20 | - | - | 38.90 | 228.34 |

Sample Size:

| 4 | 4 | 4 | - | 7 | 7 | 7 | - |

Mean:

| 5703 | 49 | 3.62 | - | 14759 | 452.5 | 5.56 | - |

Standard Deviation:

| 1835.4 | 32.24 | .95 | | 16311.86 | 379.04 | 1.42 | - |

Variability Factor:

| - | 7.00 | - | - | - | 15.79 | - | - |

ANOVA Calculations:

$$SSB = \left[ \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right) \right] - \left( \frac{\left[ \sum_{i=1}^{k} T_i \right]^2}{N} \right)$$

$$SSW = \left[ \sum_{i=1}^{k} \sum_{j=1}^{n_i} x_{i,j}^2 \right] - \sum_{i=1}^{k} \left( \frac{T_i^2}{n_i} \right)$$

MSB = SSB/(k-1)

MSW = SSW/(N-k)

F   = MSB/MSW

<div align="center">*Example 3  (continued)*</div>

where,

k    = number of treatment technologies

$n_i$   = number of data points for technology i

N    = number of data points for all technologies

$T_i$   = sum of natural log transformed data points for each technology

$X_{ij}$ = the natural log transformed observations (j) for treatment technology (i)

$N_1 = 4$, $N_2 = 7$, $N = 11$, $k = 2$, $T_1 = 14.49$, $T_2 = 38.90$, $T = 53.39$, $T^2 = 2850.49$, $T_1^2 = 209.96$

$T_2^2 = 1513.21$

$$SSB = \left[ \frac{209.96}{4} + \frac{1513.21}{7} \right] - \frac{2850.49}{11} = 9.52$$

$$SSW = (55.20 + 228.34) - \left( \frac{209.96}{4} + \frac{1513.21}{7} \right) = 14.88$$

$MSB = 9.52/1 = 9.52$

$MSW = 14.88/9 = 1.65$

$F = 9.52/1.65 = 5.77$

<div align="center">ANOVA Table</div>

| Source | Degrees of freedom | SS | MS | F |
|--------|--------|--------|--------|--------|
| Between(B) | 1 | 9.53 | 9.53 | 5.77 |
| Within(W) | 9 | 14.89 | 1.65 | |

The critical value of the F test at the 0.05 significance level is 5.12. Since the F value is larger than the critical value, the means are significantly different (i.e., they are heterogeneous).

Note: All calculations were rounded to two decimal places. Results may differ depending upon the number of decimal places used in each step of the calculations.

<div align="center">A-10</div>

## A.2. Variability Factor

$$VF = \frac{C_{99}}{Mean}$$

where:

VF = estimate of daily maximum variability factor determined from a sample population of daily data.

$C_{99}$ = Estimate of performance values for which 99 percent of the daily observations will be below. $C_{99}$ is calculated using the following equation: $C_{99} = Exp(y + 2.33\ Sy)$ where $y$ and $Sy$ are the mean and standard deviation, respectively, of the logtransformed data.

Mean = average of the individual performance values.

EPA is establishing this figure as an instantaneous maximum because the Agency believes that on a day-to-day basis the waste should meet the applicable treatment standards. In addition, establishing this requirement makes it easier to check compliance on a single day. The 99th percentile is appropriate because it accounts for almost all process variability.

In several cases, all the results from analysis of the residuals from BDAT treatment are found at concentrations less than the detection limit. In such cases, all the actual concentration values are considered unknown and hence, cannot be used to estimate the variability factor of the analytical results. Below is a description of EPA's approach for calculating the variability factor for such cases with all concentrations below the detection limit.

It has been postulated as a general rule that a lognormal distribution adequately describes the variation among concentrations.

Agency data shows that the treatment residual concentrations are distributed approximately lognormally. Therefore, the lognormal model has been used routinely in the EPA development of numerous regulations in the Effluent Guidelines program and is being used in the BDAT program. The variability factor (VF) was defined as the ratio of the 99th percentile $(C_{99})$ of the lognormal distribution to its arithmetic mean (Mean).

$$VF = \frac{C_{99}}{Mean} \tag{1}$$

The relationship between the parameters of the lognormal distribution and the parameters of the normal distribution created by taking the natural logarithms of the lognormally-distributed concentrations can be found in most mathematical statistics texts (see for example: Distribution in Statistics-Volume 1 by Johnson and Kotz, 1970). The mean of the lognormal distribution can be expressed in terms of the mean $(\mu)$ and standard deviation $(\sigma)$ of the normal distribution as follows:

$$C_{99} = Exp \ (\mu + 2.33\sigma) \tag{2}$$
$$Mean = Exp \ (\mu + .5\sigma^2) \tag{3}$$

Substituting (2) and (3) in (1) the variability factor can then be expressed in terms of $\sigma$ as follows:

$$VF = Exp \ (2.33 \ \sigma - .5\sigma^2) \tag{4}$$

For residuals with concentrations that are not all below the detection limit, the 99th percentile and the mean can be estimated from the actual analytical data and accordingly, the variability factor (VF)

can be estimated using equation (1). For residuals with concentrations
that are below the detection limit, the above equations can be used in
conjunction with the assumptions below to develop a variability factor.

Step 1:  The actual concentrations follow a lognormal distribution. The
upper limit (UL) is equal to the detection limit. The lower limit (LL)
is assumed to be equal to one tenth of the detection limit. This
assumption is based on the fact that data from well-designed and
well-operated treatment systems generally falls within one order of
magnitude.

Step 2:  The natural logarithms of the concentrations have a normal
distribution with an upper limit equal to ln (UL) and a lower limit equal
to ln (LL).

Step 3:  The standard deviation ($\sigma$) of the normal distribution is
approximated by

$\sigma = [(\ln (UL) - \ln (LL)] / [(2)(2.33)] = [\ln(UL/LL)] / 4.66$

when LL = (0.1)(UL) then $\sigma = (\ln 10) / 4.66 = 0.494$

Step 4:  Substitution of the value from Step 3 in equation (4) yields the
variability factor, VF.

VF = 2.8

# APPENDIX B

## MAJOR CONSTITUENT CALCULATION FOR KO16, KO18, KO19, KO20, AND KO30

B.1     <u>KO16</u>

From Table 2-4, major constituents in KO16 are:

|  | Average*<br>Concentration<br>(ppm) | % |
|---|---|---|
| 42. Tetrachloroethene | 85,750 | 8.6 (=9) |
| 110. Hexachlorobenzene | 27,050 | 2.7 (=3) |
| 111. Hexachlorobutadiene | 59,250 | 5.9 (=6) |
| 113. Hexachloroethane | 30,000 | 3.0 |

Other BDAT constituents in KO16 are:

|  | Average*<br>Concentration<br>(ppm) | % |
|---|---|---|
| 112. Hexachlorocyclopentadiene | 6,275 | 0.63 (=1) |

Thus, the major constituents list for KO16 is:

| Constituent | % |
|---|---|
| 42. Tetrachoroethene | 9 |
| 110. Hexachlorobenzene | 3 |
| 111. Hexachlorobutadiene | 6 |
| 113. Hexachloroethane | 3 |
| Other BDAT Constituents | 1 |
| Other Constituents | <u>78</u> |
|  | 100% |

*Average concentrations were calculated by averaging available data from all sources. Where a concentration value was reported as less than a detection limit, the detection limit was used in the calculation. Where concentrations were reported as a range of values, the average over the range was used and then averaged with other data.

B.2     KO18

From Table 2-5, major constituents in KO18 are:

|  | | Average* Concentration (ppm) | % |
|---|---|---|---|
| 12. | Chloroethane | 131,000 | 13.1 (=13) |
| 22. | 1,1-Dichloroethane | 356,800 | 35.6 (=36) |
| 23. | 1,2-Dichloroethane | 50,000 | 5.0 (=5) |
| 46. | 1,1,2-Trichloroethane | 11,600 | 1.2 (=1) |

Other BDAT constituents in KO18 are:

|  | | Average* Concentration (ppm) |
|---|---|---|
| 15. | Chloromethane | 8,300 |
| 45. | 1,1,1-Trichloroethane | 3,325 |
| 110. | Hexachlorobenzene | 385 |
| 111. | Hexachlorobutadiene | 386 |
| 113. | Hexachloroethane | 381 |
| 137. | Pentachlorethane | 528 |
|  |  | 13,305 ppm ---> 1.3 (=1.0%) |

Thus, the major constituent list for KO18 is:

| | Constituent | % |
|---|---|---|
| 12. | Chloroethane | 13 |
| 22. | 1,1-Dichloroethane | 36 |
| 23. | 1,2-Dichloroethane | 5 |
| 46. | 1,1,2-Trichloroethane | 1 |
|  | Other BDAT Constituents | 1 |
|  | Other Constituents | 44 |
|  |  | 100% |

*Average concentrations were calculated by averaging available data from all sources. Where a concentration value was reported as less than a detection limit, the detection limit was used in the calculation. Where concentrations were reported as a range of values, the average over the range was used and then averaged with other data.

B.3    K019

The following major constituent list for K019 is from
Reference 10: "Onsite Engineering Report of Treatment
Technology Performance and Operation for Rollins Environ-
mental Services (TX) Inc., Deer Park, Texas".

| | Constituent | % |
|---|---|---|
| 23. | 1,2-Dichloroethane | 10 |
| 46. | 1,1,2-Trichloroethane | 4 |
| | Other BDAT constituents | 2 |
| | Other Constituents | 82 |
| | Water | 2 |
| | | 100% |

B.4    K020

From Table 2-7, major constituents in K020 are:

| | | Average* Concentration (ppm) | % |
|---|---|---|---|
| 23. | 1,2-Dichloroethane | 555,000 | 55.5 (=56) |
| 41. | 1,1,2,2-Tetrachloroethane | 77,000 | 7.7 (=8) |
| 42. | Tetrachloroethene | 28,000 | 2.8 (=3) |
| 46. | 1,1,2-Trichloroethane | 35,000 | 3.5 (=4) |

Thus, the major constituent list for K020 is:

| | Constituent | % |
|---|---|---|
| 23. | 1,2-Dichloroethane | 56 |
| 41. | 1,1,2,2-Tetrachloroethane | 8 |
| 46. | 1,1,2-Trichloroethane | 4 |
| 42. | Tetrachloroethene | 3 |
| | Other Constituents | 29 |
| | | 100% |

*Average concentrations were calculated by averaging available data from all
sources. Where a concentration value was reported as less than a detection
limit, the detection limit was used in the calculation. Where concentrations
were reported as a range of values, the average over the range was used and
then averaged with other data.

B.5    KO30

From Table 2-8, major constituents in KO30 are:

|     | Constituent | Average* Concentration (ppm) | % |
|-----|-------------|------------------------------|---|
| 42. | Tetrachloroethene | 555,000 | 55.5 (=56) |
| 111. | Hexachlorobutadiene | 38,000 | 3.8 (=4) |
| 137. | Pentachloroethane | 22,000 | 2.2 (=2) |

Other BDAT Constituents in KO30 are:

|     | Constituent | Average* Concentration (ppm) |
|-----|-------------|------------------------------|
| 87. | o-Dichlorobenzene | 1,950 |
| 88. | p-Dichlorobenzene | 2,100 |
| 112. | Hexachlorocyclopentadiene | 1,270 |
| 113. | Hexachloroethane | 7,700 |
| 115. | Hexachloropropene | 3,550 |
| 136. | Pentachlorobenzene | 2,750 |
| 148. | 1,2,4,5-Tetrachlorobenzene | 2,950 |
| 150. | 1,2,4-Trichlorobenzene | 4,850 |
|     |     | 27,120  ---> 2.7% (=3%) |

Thus, the major constituents list for KO30 is:

|     | Constituent | % |
|-----|-------------|---|
| 42. | Tetrachloroethene | 56 |
| 111. | Hexachlorobutadiene | 4 |
| 137. | Pentachloroethane | 2 |
|     | Other BDAT Constituents | 3 |
|     | Other Constituents | 35 |
|     |     | 100% |

*Average concentrations were calculated by averaging available data from all sources. Where a concentration value was reported as less than a detection limit, the detection limit was used in the calculation. Where concentrations were reported as a range of values, the average over the range was used and then averaged with other data.

APPENDIX C


STRIP CHARTS FOR THE SAMPLING EPISODE AT PLANT A:

WASTE FEED RATES, KILN TEMPERATURES, AFTERBURNER

TEMPERATURES AND EXCESS OXYGEN CONCENTRATION

Figure C-1

RCRA BLEND FEED RATES (lb/min)
(Continued)

C-1
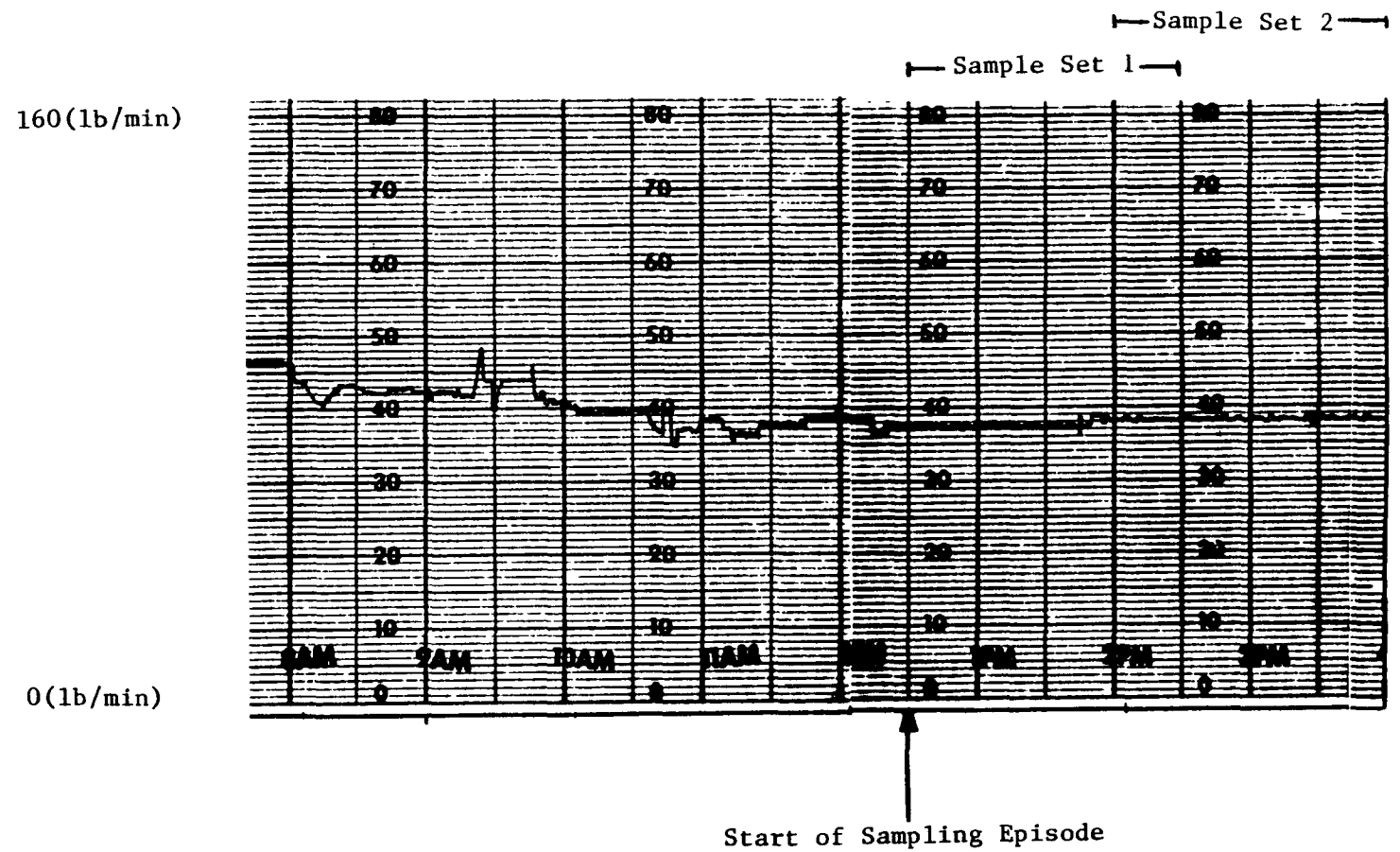
Figure C-2

PCB BLEND FEED RATE (lb/min)
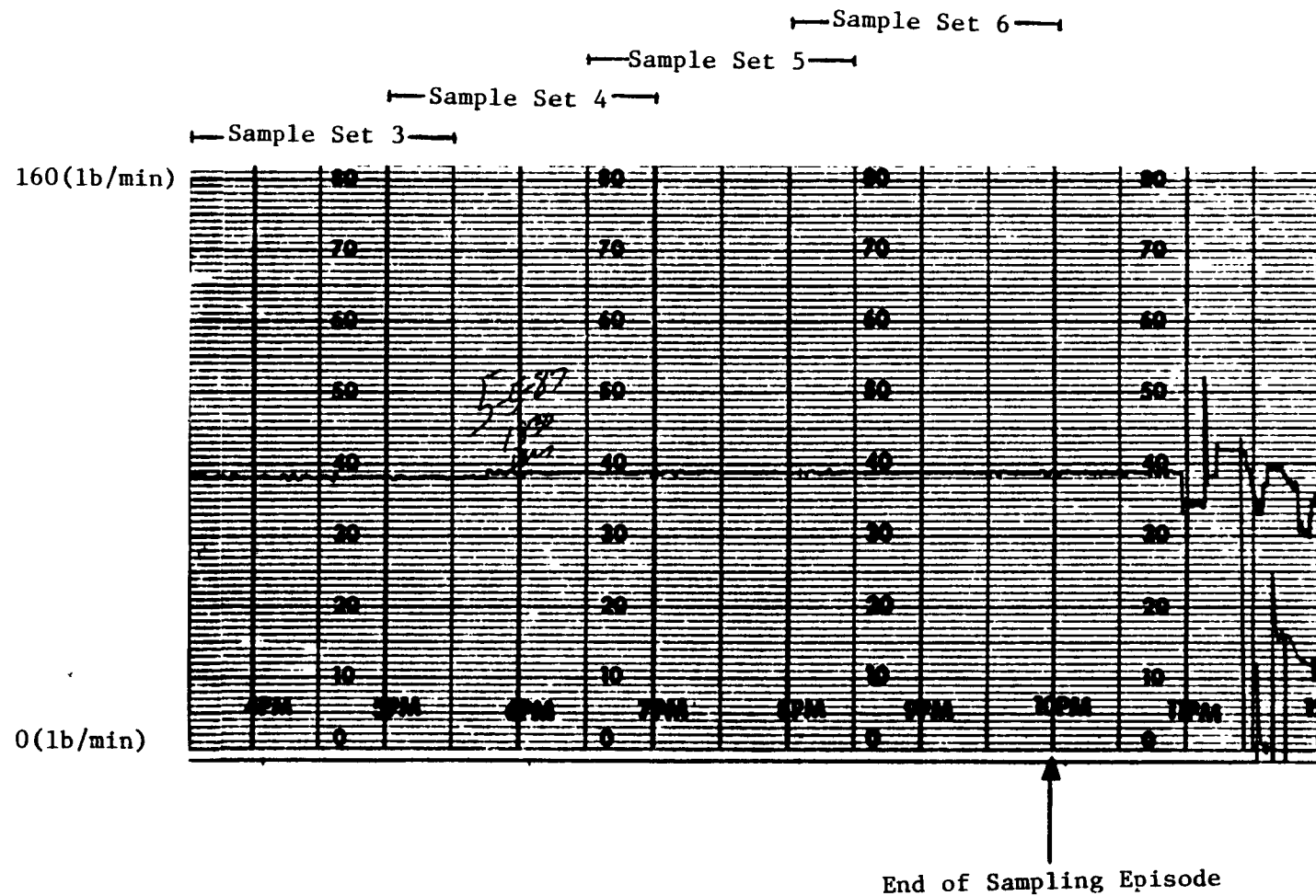
Figure C-2

PCB BLEND FEED RATE (lb/min)
(Continued)
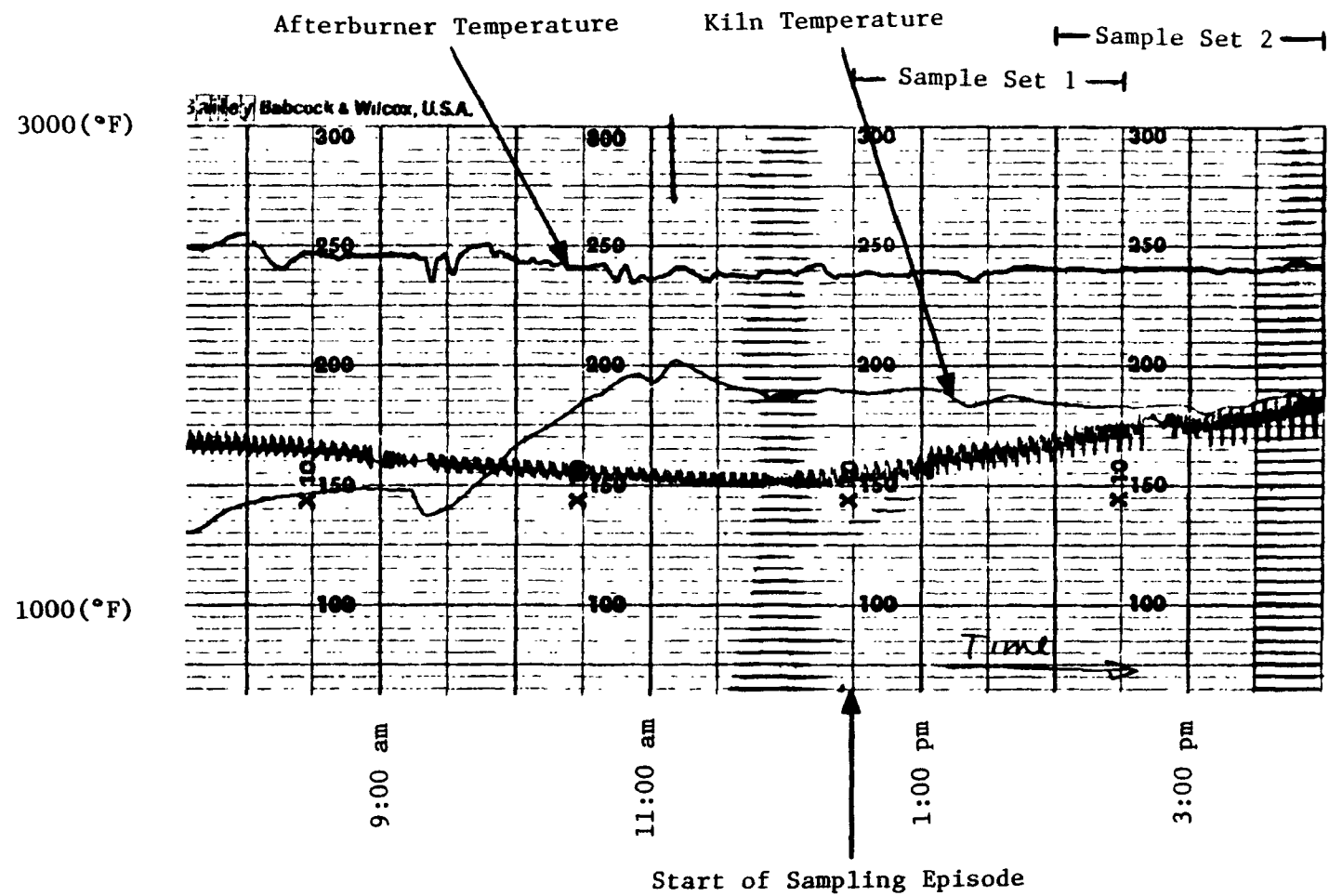
Figure C-3

KILN AND AFTERBURNER TEMPERATURES (°F)
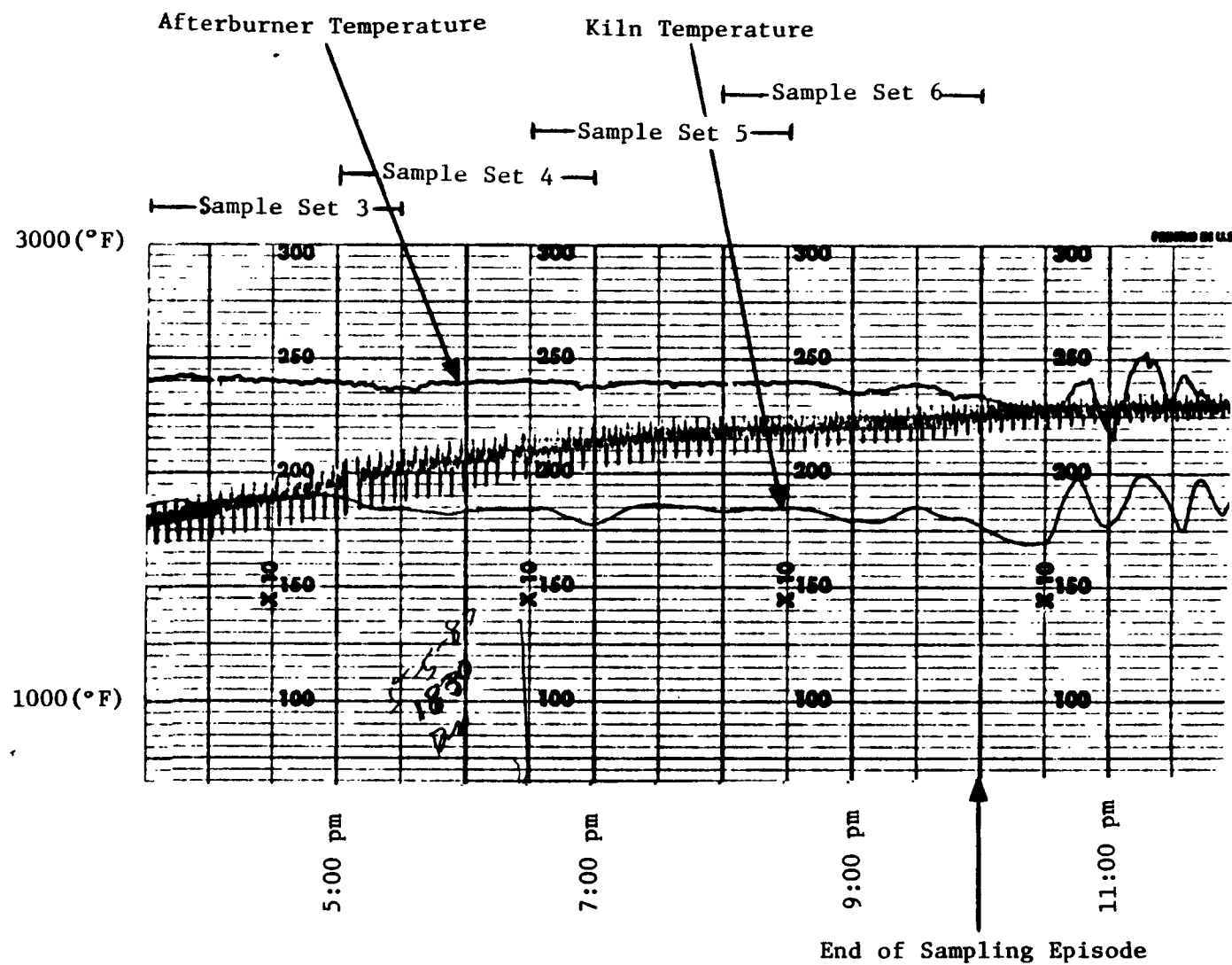
Figure C-3

KILN AND AFTERBURNER TEMPERATURES (°F)

(Continued)

C-5
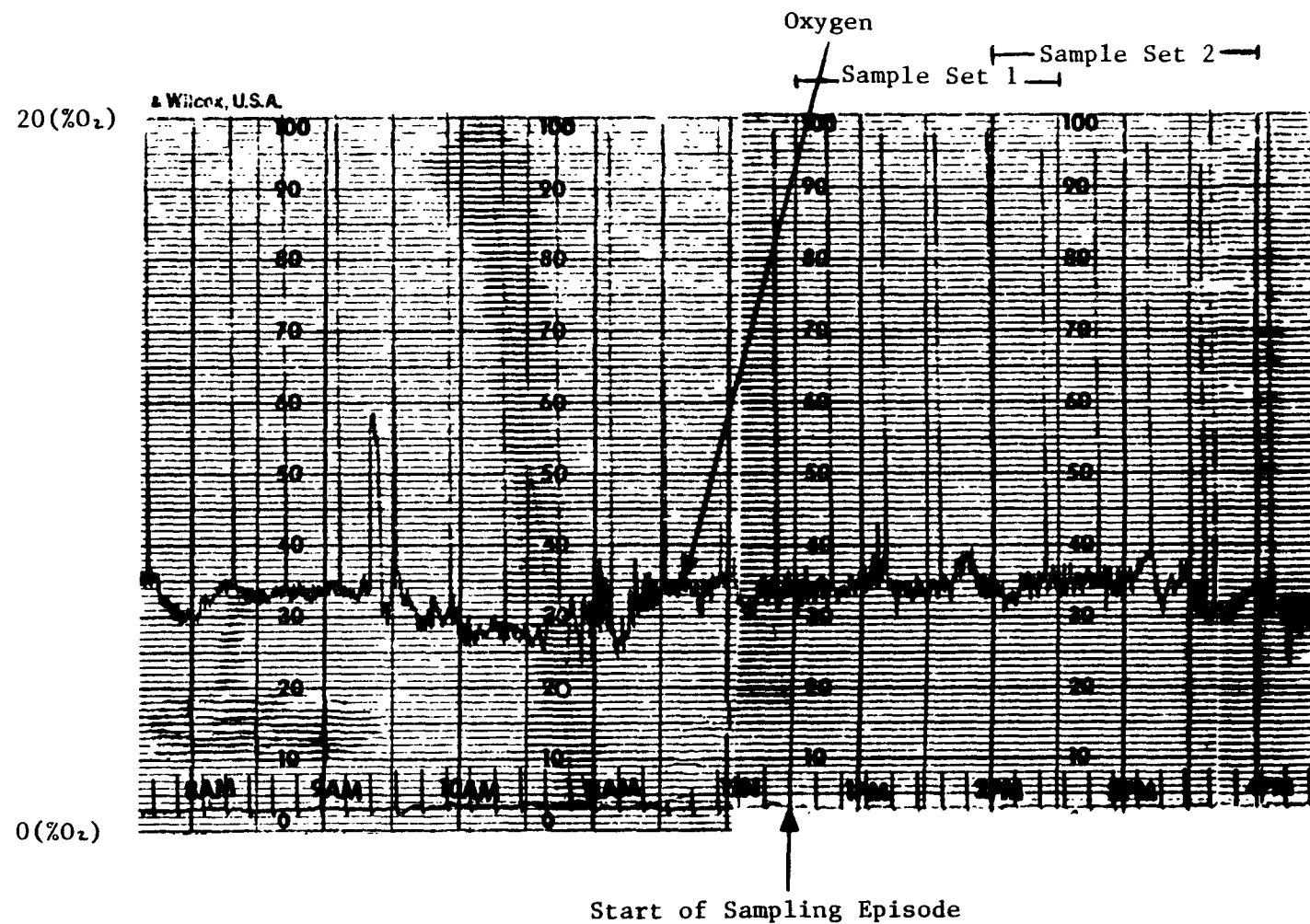
Figure C-4

HOT DUCT OXYGEN CONCENTRATION (%)
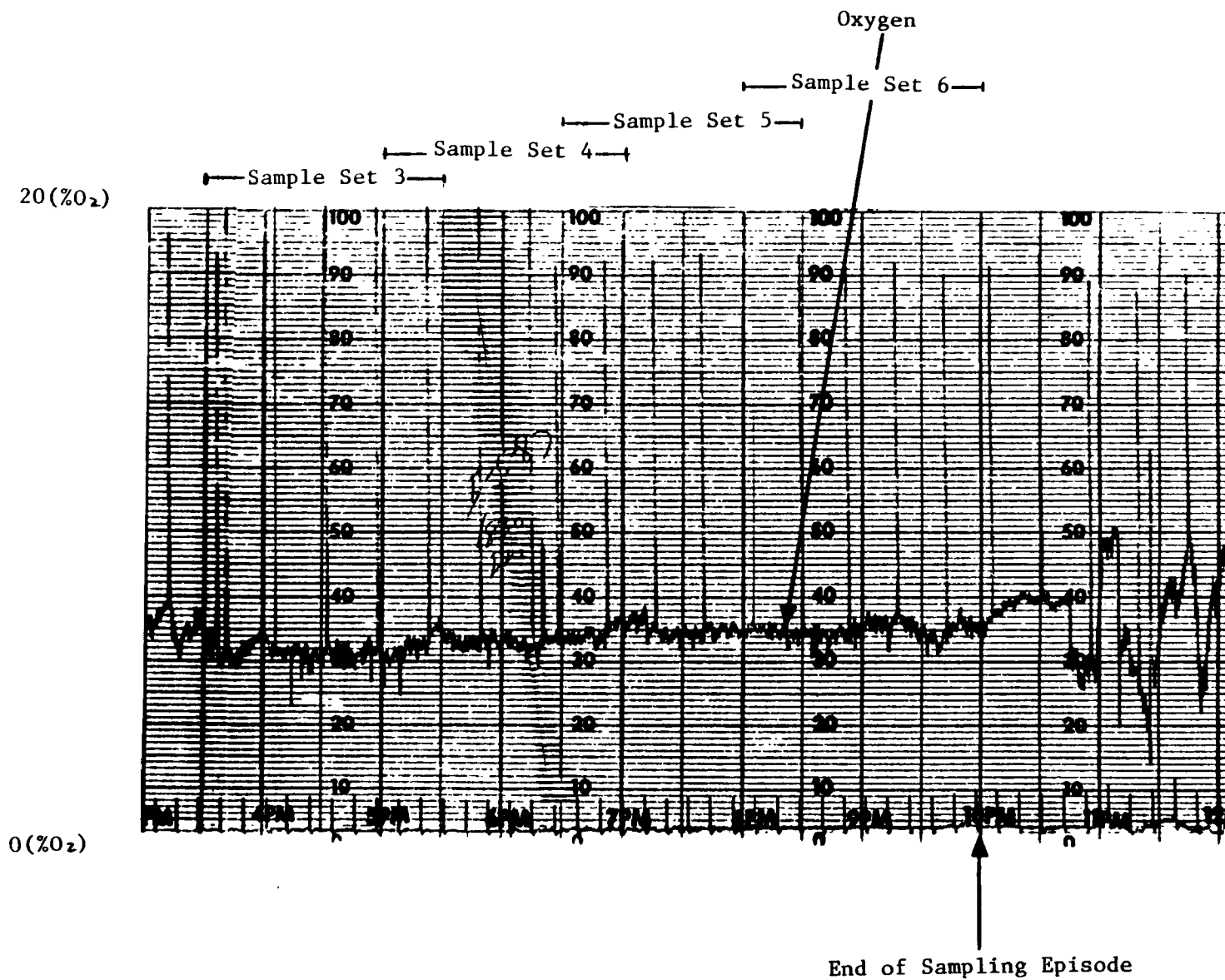
Figure C-4

HOT DUCT OXYGEN CONCENTRATION (%)

(Continued)

APPENDIX D

ANALYTICAL QA/QC


The analytical methods used for analysis of the regulated constituents identified in Section 5.0 are presented in this Appendix. SW-846 methods (EPA's Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846) are used in most cases for determining total constituent concentration.


In some instances it was necessary to deviate from the SW-846 methods. Deviations from SW-846 methods required to analyze the sample matrix are listed in Table D-2. SW-846 allows for the use of alternative or equivalent procedures or equipment; these are noted in Table D-3. These alternatives or equivalents included alternative GC/MS operating conditions, equivalent base/neutral surrogates, and different extraction techniques to reduce sample matrix interferences.


The accuracy determination for a constituent is based on the matrix spike recovery values. Tables D-4, D-5, and D-7 present the matrix spike recovery data for volatile and semivolatile constituents in the kiln ash and scrubber water residuals.


The accuracy correction factors for volatile and semivolatile constituents detected in untreated K019 and in the kiln ash and scrubber water residuals are summarized in Table D-6. The accuracy correction factors were determined for each constituent by dividing 100 by the matrix spike recovery (in percent) for that constituent.

Table D-1

ANALYTICAL METHODS FOR REGULATED CONSTITUENTS

Nonwastewater

| Regulated Constituent | Kiln Ash Residue Total Constituent Concentration | | | Combustion Gas Scrubber Discharge Water Total Constituent Concentration | | |
|---|---|---|---|---|---|---|
| | Preparation Method | Analytical Method | Reference | Preparation Method | Analytical Method | Reference |
| Volatile | | | | | | |
| 9. Chlorobenzene<br>14. Chloroform<br>23. 1,2-Dichloroethane<br>42. Tetrachloroethene<br>45. 1,1,1-Trichloroethane | Purge and Trap (Method 5030) | Gas Chromatography/ Mass Spectrometry for Volatile Organics (Method 8240) | * | Purge and Trap (Method 5030) | Gas Chromatography/ Mass Spectrometry for Volatile Organics (Method 8240) | * |
| Semivolatile | | | | | | |
| 68. Bis(2-chloroethyl)ether<br>113. Hexachloroethane<br>121. Naphthalene<br>141. Phenanthrene<br>150. 1,2,4-Trichlorobenzene | Sonication Extraction* (Method 3550) | Gas Chromatography/ Mass Spectrometry for Semivolatile Organics: Capillary Column Technique (Method 8270) | * | Separatory Funnel Liquid- Liquid Extraction (Method 3510) | Gas Chromatography/ Mass Spectrometry for Semivolatile Organics Capillary Column Technique (Method 8070) | * |

Reference:

*Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Third Edition, U.S. EPA, Office of Solid Waste and Emergency Response, November 1986.

Table D-1 (Continued)

ANALYTICAL METHODS FOR REGULATED CONSTITUENTS

Wastewater

| Regulated Constituent | Kiln Ash Residue Total Constituent Concentration | | | Combustion Gas Scrubber Constituent Concentration | | |
|---|---|---|---|---|---|---|
| | Preparation Method | Analytical Method | Reference | Preparation Method | Analytical Method | Reference |
| **Volatile** | | | | | | |
| 7. Carbon Tetrachloride | Purge and | Gas Chromatography/ | * | Purge and | Gas Chromatography/ | * |
| 14. Chloroform | Trap | Mass Spectrometry | | Trap | Mass Spectrometry | |
| 23. 1,2-Dichloroethane | (Method | for Volatile Organics | | (Method | for Volatile Organics | |
| 42. Tetrachloroethene | 5030) | (Method 8240) | | 5030) | (Method 8240) | |
| 46. 1,1,2-Trichloroethane | | | | | | |
| **Semivolatile** | | | | | | |
| 68. Bis(2-chloroethyl)ether | Sonication | Gas Chromatography/ | * | Separatory | Gas Chromatography/ | * |
| 88. p-Dichlorobenzene | Extraction* | Mass Spectrometry | | Funnel | Mass Spectrometry | |
| 110. Hexachlorobenzene | (Method | for Semivolatile | | Liquid- | for Semivolatile | |
| 113. Hexachloroethane | 3550) | Organics: Capillary | | Liquid | Organics Capillary | |
| 121. Naphthalene | | Column Technique | | Extraction | Column Technique | |
| 136. Pentachlorobenzene | | (Method 8270) | | (Method | (Method 8070) | |
| 148. 1,2,4,5-Tetrachlorobenzene | | | | | 3510) | |
| 150. 1,2,4-Trichlorobenzene | | | | | | |

Reference:

*Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Third Edition, U.S. EPA, Office of Solid Waste and Emergency Response, November 1986.

Table D-2  Deviations from SW-846

| Analysis | Method | SW-846 Specification | Deviation from SW-846 Method | Rationale for Deviation |
|---|---|---|---|---|
| Continuous Liquid/ Liquid Extraction or Soxhlet Extraction or Separatory Funnel Liquid/Liquid Extraction or Sonication | 3520 3540 3510 3550 | Add 1 0 ml of solution containing 100 ug/ml of the acid surrogates and 200 ug/ml of the base/neutral surrogates Additional amounts of the surrogates if high concentration samples are expected | 0.1 ml of a solution containing 1,000 ug/ml of the acid surrogates and 2,000 ug/ml of the base/neutral surrogates were added to the samples. The final concentration of the surrogates in the extracts is the same as specified in SW-846 | |
| | | Use a micro Snyder column to adjust the concentrate volumes | Nitrogen was used to adjust the concentrate volumes for these samples due to the high organic content of the samples. | The use of nitrogen reduced potential sample loss due to bumping that could occur during the concentration of the extracts of these samples |
| Continuous Liquid/ Liquid Extraction | 3520 | Method calls for use 10 N NaOH and 1:1 N $H_2SO_4$. | More concentrated acid and base solutions were used for buffered samples (e.g., 2 1 $H_2SO_4$) and 12 N NaOH). | Buffered samples require the addition of large amounts of liquids to accomplish pH changes. Using more concentrated acid and base solutions reduces the amount of acid or base needed and avoids overfilling the extractor with aqueous phase. |
| Sonication Extraction | 3550 | SW-846 specifies 3 minutes of sonication. | Sonication is performed for five minutes | The extended sonication ensures the thorough mixing of these samples. |
| | | No acidification step is required. | The base/neutral extracted kiln ash residue is acidified with 1 ml of 1:1 $H_2SO_4$, dried with $Na_2SO_4$ (10 g), and reextracted. The extracts will be combined. | This acidification step yields better recoveries of the acid extractables. |
| | | Either decant extracts and filter through No. 41 paper by vacuum or centrifuge and decant. | Vacuum filtration is not used Decanting is usually done without centrifugation. | This technique reduces sample transfer steps when samples can be decanted without centrifugation. |

D-5

| Analysis | Method | SW-846 Specification | Deviation from SW-846 Method | Rationale for Deviation |
|---|---|---|---|---|
| Gas Chromatography/ Mass Spectrometry for Semivolatile Organics. Capillary Column Technique | 8270 | The internal standards recommended are 1,4-dichlorobenzene-$d_4$, napthalene-$d_8$, acenaphthene-$d_{10}$, phenanthrene-$d_{10}$, chrysene-$d_{12}$, and perylene-$d_{12}$. Other compounds may be used as internal standards as long as the requirements given in Paragraph 7.3.2 of the method are met. Each compound is dissolved with a small volume of carbon disulfide and diluted to volume with methylene chloride so that the final solvent is approximately 20% carbon disulfide. Most of the compunds are also soluble in small volumes of methanol, acetone, or toluene, except for perylene-$d_{12}$. The resulting solution will contain each standard at a concentration of 4,000 ng/uL. Each 1-mL sample extract undergoing analysis should be spiked with 10 uL of the internal standard solution, resulting in a concentration of 40 ng/uL of each internal standard. | The preparation of the internal standards was changed to eliminate carbon disulfide as a solvent. The internal standard concentration was changed to 50 ng/ul instead of 40 ng/ul. The standards were dissolved in methylene chloride only. Perylene-$d_{12}$ dissolved in methylene chloride sufficiently to yield reliable results. | |
| Separatory Funnel Liquid/Liquid Extraction | 3510 | Extract sample at high pH and then at low pH. | The combustion gas effluent water residue is extracted at low pH first and then at high pH. | |
| Sulfides | 9030 | No sample preparation given in Method 9030 for solid waste matrix. | Sample preparation required due to matrix of samples. Distillation of sulfide from the acid solution was used with the sorption of $H_2S$ in NaOH. This method is described in EPA's "Test Method to Determine Hydrogen Sulfide Released from Wastes." | Distillation procedure used to liberate sulfide from various matrices and to reduce potential interferences. SW-846 Method 9030 is applicable only for water samples (drinking, surface, and saline wastes), therefore sample preparation required for other matrices. |

Table D-3 Specific Procedures or Equipment Used in Extraction of Organic Compounds When Alternatives or Equivalents are Allowed in the SW-846 Methods

| Analysis | SW-846 Method | Sample Aliquot | Alternatives or Equivalents Allowed by SW-846 Methods | Specific Procedures or Equipment Used |
|---|---|---|---|---|
| Purge and Trap | 5030 | 5 milliliters of liquid or 2 grams of solid | • The purge and trap device to be used is specified in the method in Figure 1, the desorber to be used is described in Figures 2 and 3, and the packing materials are described in Section 4 10 2 The method allows equivalents of this equipment or materials to be used | • The purge and trap equipment, the desorber, and the packing materials used were as specified in SW-846 |
| | | | • The method specifies that the trap must be at least 25 cm long and have an inside diameter of at least 0 105 in | • The length of the trap was 30 cm and the diameter was 0 25 cm |
| | | | • The surrogates recommended are toluene-d8,4-bromofluorobenzene, and 1,2-dichloroethane-d4 The recommended concentration level is 0 25 ug/ml. | • All 3 surrogates were added at the concentration recommended in SW-846 |
| Continuous Liquid-Liquid Extraction | 3520 | 1 liter of liquid | • Acid and base/neutral extracts are usually combined before analysis by GC/MS However, under some situations, they may be extracted and analyzed separately | • Acid and base/neutral extracts were combined with the exception of the sample collected from the filtration dewatering of DAF float mixture |

D-6

| Analysis | SW-846 Method | Sample Aliquot | Alternatives or Equivalents Allowed by SW-846 Methods | Specific Procedures or Equipment Used |
|---|---|---|---|---|
| Continuous Liquid-Liquid Extraction (continued) | | | • The base/neutral surrogates recommended are 2-fluorobiphenyl, nitrobenzene-d5, terphenyl-d14 The acid surrogates recommended are 2-fluorophenol, 2,4,6-tribromophenol, and phenol-d6. Additional compounds may be used for surrogates The recommended concentrations for low-medium concentration level samples are 100 ug/ml for acid surrogates and 200 ug/ml for base/neutral surrogates. Volume of surrogates added may be adjusted | • Surrogates were the same as those recommended by SW-846 with the exception that phenol-d5 was substituted for phenol-d6 The concentrations of surrogates in the samples were 100 ug/ml of acid surrogates and 200 ug/ml of base/neutral surrogates. |
| Soxhlet Extraction | 3540 | 10 grams of solid | • The recommended surrogates and their concentration levels are the same as for Method 3520. | • The surrogates used and their concentration levels were the same as for Method 3520. |
| | | | • Sample grinding may be required for samples not passing through a 1 mm standard sieve or a 1 mm opening. | • Sample grinding was not required. |

| Analysis | SW-846 Method | Sample Preparation Method | Alternatives or Equivalents Allowed in SW-846 for Equipment or in Procedure | | Specific Equipment or Procedures Used | |
|---|---|---|---|---|---|---|
| | | | • Recommended GC/MS operating conditions | | • Actual GC/MS operating conditions | |
| Gas Chromatography/ Mass Spectrometry for volatile organics | 8240 | 5030 | Electron energy | 70 vols (nominal) | Electron energy | 70 ev |
| | | | Mass range. | 35-260 amu | Mass range | 35 - 350 amu |
| | | | Scan time. | To give 5 scans/peak but not to exceed 7 sec/scan | Scan time | 2 sec/scan |
| | | | Initial column temperature: | 45°C | Initial column temperature | 10 C |
| | | | Initial column holding time. | 3 min | Initial column holding time | 5 min |
| | | | Column temperature program | 8°C/min | Column temperature program | 6 C/min |
| | | | Final column temperature | 200°C | Final column temperature | 160 C |
| | | | Final column holding time | 15 min | Final column holding time | 20 min |
| | | | Injector temperature | 200-225°C | Injector temperature | 220 C |
| | | | Source temperature: | According to manufacturer's specification | Source temperature | 250°C |
| | | | Transfer line temperature | 250-300°C | Transfer line temperature | 275 C |
| | | | Carrier gas | Hydrogen at 50 cm/sec or helium at 30 cm/sec | Carrier gas | Helium @ 30 ml/min |

• Additional Information on Actual System Used
Equipment   Finnegan Mat model 5100 GC/MS/DS system
Data system   SUPERINCOS[R]
Mode   Electron impact
NBS library available
Interface to MS - Jet separator

| | | | • The column should be 6-ft x 0.1 in I.D. glass, packed with 1% SP-1000 on Cartopack B (60/80 mesh) or an equivalent. | | • The column used was a capillary VOCOL which is 60 meters long and has an inner diameter of 0.75 mm and a 1.5 $\mu md_f$ | |
| | | | Samples may be analyzed be purge and trap technique or by direct injection | | • All samples were analyzed using the purge and trap technique | |

| Analysis | SW-846 Method | Sample Preparation Method | Alternatives or Equivalents Allowed in SW-846 for Equipment or in Procedure | | Specific Equipment or Procedures Used | |
|---|---|---|---|---|---|---|
| Gas Chromatography/ Mass Spectrometry for semivolatile organics. capillary column technique | 8270 | 3520-Liquids 3540-Solids | • Recommended GC/MS operating conditions | | • Actual GC/MS operating conditions | |
| | | | Mass range. | 35-500 amu | Mass range | 35 - 450 amu |
| | | | Scan time: | 1 sec/scan | Scan time | 0 5 sec/scan |
| | | | Initial column temperature | 40°C | Initial column temperature | 35°C |
| | | | Initial column holding time | 4 min | Initial column holding time | 3 5 min |
| | | | Column temperature program· | 40-270°C at 10°C/min | Column temperature program | 35°C at 10°C/min |
| | | | Final column temperature hold· | 270°C (until benzo[g,h,i,]perylene has eluted) | Final column temperature hold· | 275°C |
| | | | | | Injector temperature. | 275°C |
| | | | Injector temperature | 250-300°C | Transfer line temperature. | 275°C |
| | | | Transfer line temperature· | 250-300°C | Source temperature | 250°C |
| | | | Source temperature. | According to manufacturer's specification | | |
| | | | Injector: | Grob-type, splitless | Injector· | Cool-on-column at 35°C |
| | | | Sample volume· | 1-2 uL | Sample volume | 1 uL of sample extract |
| | | | Carrier gas· | Hydrogen at 50 cm/sec or helium at 30 cm/sec | Carrier gas | Hydrogen @ 50 ml/min |

• The column should be 30 m by 0 25 mm I.D., 1-um film thickness silicon-coated fused silica capillary column (J&W Scientific DB-5 or equivalent)

• Additional Information on Actual System Used Equipment. Hewelett Packard 5987A GC/MS (Operators Manual Revision B) Software Package AQUARIUS NBS library available

• The column used was the J&W scientific DB-5 silica capillary column It is 60 meters with a 0 32 mm capillary column inner diameter and a 1 0 um film

MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUE

| | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| Spike Constituent | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| VOLATILES | | | | | | | |
| 4. Benzene | <2 | 25 | 22.6 | 90 | 25 | 21.2 | 85 |
| 7. Carbon Tetrachloride | ** | | | | | | |
| 9. Chlorobenzene | <2 | 25 | 24.8 | 99 | 25 | 25 | 100 |
| 14. Chloroform | ** | | | | | | |
| 22. 1,1-Dichloroethane | ** | | | | | | |
| 23. 1,2-Dichloroethane | ** | | | | | | |
| 24. 1,1-Dichloroethylene | <2 | 25 | 21.2 | 85 | 25 | 19.4 | 78 |
| 42. Tetrachloroethene | ** | | | | | | |
| 43. Toluene | ** | | | | | | |
| 45. 1,1,1-Trichloroethane | ** | | | | | | |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 94% from the duplicate sample result.

## MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUE

| Spike Constituent | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| **VOLATILES** (Continued) | | | | | | | |
| 47. Trichloroethene | <2 | 25 | 26.8 | 107 | 25 | 28 | 112 |
| AVERAGE RECOVERY FOR VOLATILES | | | | 95 | | | 94 |
| **SEMIVOLATILES (BASE/NEUTRAL FRACTION)** | | | | | | | |
| 52. Acenaphthene | <2 | 50 | 55 | 110 | 50 | 55 | 110 |
| 68. Bis(2-chloroethyl)ether | + | | | | | | |
| 70. Bis(2-ethylhexyl) phthalate | + | | | | | | |
| 88. 1,4-Dichlorobenzene | <2 | 50 | 45 | 90 | 50 | 49.5 | 99 |
| 98. Di-n-butylphthalate | + | | | | | | |
| 102. 2,4-Dinitrotoluene | <50 | 50 | 53.5 | 107 | 50 | 55 | 110 |
| 105. N-Nitroso-di-n-propylamine | <5 | 50 | 60 | 120 | 50 | 65 | 130 |

*Percent recovery = $100 \times (C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 94% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 103% from the duplicate sample result.

MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUE

| | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| Spike Constituent | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| SEMIVOLATILES (Continued) | | | | | | | |
| 109. Fluorene | + | | | | | | |
| 110. Hexachlorobenzene | + | | | | | | |
| 113. Hexachloroethane | + | | | | | | |
| 121. Naphthalene | + | | | | | | |
| 136. Pentachlorobenzene | + | | | | | | |
| 141. Phenanthrene | + | | | | | | |
| 145. Pyrene | <2 | 50 | 60 | 120 | 50 | 46 | 92 |
| 148. 1,2,4,5-Tetrachloro-benzene | + | | | | | | |
| 150. 1,2,4-Trichlorobenzene | <5 | 50 | 37.5 | 75 | 50 | 40 | 80 |
| AVERAGE RECOVERY FOR SEMIVOLATILES (BASE/NEUTRAL) | | | | 104 | | | 103 |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 94% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery for this constituent is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 103% from the duplicate sample result.

Table D-5

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| Spike Constituent | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| VOLATILES | | | | | | | |
| 4. Benzene | <2 | 25 | 21 | 84 | 25 | 17 | 68 |
| 7. Carbon Tetrachloride | ** | | | | | | |
| 9. Chlorobenzene | <2 | 25 | 29 | 116 | 25 | 23 | 92 |
| 14. Chloroform | ** | | | | | | |
| 21. Dichlorodifluoromethane | ** | | | | | | |
| 22. 1,1-Dichloroethane | ** | | | | | | |
| 23. 1,1-Dichloroethane | ** | | | | | | |
| 24. 1,1-Dichloroethylene | <2 | 25 | 12 | 48 | 25 | 11 | 44 |
| 42. Tetrachloroethene | ** | | | | | | |
| 43. Toluene | ** | | | | | | |

*Percent recovery = $100 \times (C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery used for this constituent in the proposed rule is based on the lowest percent recovery of the volatile constituents. The lowest percent recovery is 44% from 1,1-dichloroethylene.

Table D-5 (Continued)

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| Spike Constituent | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| VOLATILES (Continued) | | | | | | | |
| 46. 1,1,2-Trichloroethane | ** | | | | | | |
| 47. Trichloroethene | <2 | 25 | 21 | 84 | 25 | 27 | 108 |
| SEMIVOLATILES (Base/Neutral Fraction) | | | | | | | |
| 52. Acenaphthene | <5 | 50 | 51 | 102 | 50 | 51 | 102 |
| 68. Bis(2-chloroethyl)ether | *** | | | | | | |
| 88. 1,4-Dichlorobenzene | <2 | 50 | 34 | 68 | 50 | 35 | 70 |
| 98. Di-n-buty phthalate | *** | | | | | | |
| 102. 2,4-Dinitrotoluene | <2 | 50 | 43 | 86 | 50 | 42 | 84 |
| 105. N-Nitroso-di-N-propyLamine | <5 | 50 | 50 | 100 | 50 | 46 | 92 |
| 109. Fluorene | *** | | | | | | |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery used for this constituent in the proposed rule is based on the lowest percent recovery of the volatile constituents. The lowest percent recovery is 44% from 1,1-dichloroethylene.

***No matrix spike was performed for this constituent. The percent recovery used for this constituent in the proposed rule is based on the lowest percent recovery of the base/neutral fraction semivolatiles. The lowest percent recovery of 60% is from 1,2,4-trichlorobenzene.

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| Spike Constituent | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| SEMIVOLATILES (Continued) | | | | | | | |
| 110. Hexachlorobenzene | *** | | | | | | |
| 113. Hexachloroethane | *** | | | | | | |
| 121. Naphthalene | *** | | | | | | |
| 136. Pentachlorobenzene | *** | | | | | | |
| 141. Phenanthrene | *** | | | | | | |
| 145. Pyrene | <2 | 50 | 43 | 86 | 50 | 43 | 86 |
| 148. 1,2,4,5-Tetrachlorobenzene | *** | | | | | | |
| 150. 1,2,4-Trichlorobenzene | <10 | 50 | 30 | 60 | 50 | 34 | 68 |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

***No matrix spike was performed for this constituent. The percent recovery used for this constituent in the proposed rule is based on the lowest percent recovery of the base/neutral fraction semivolatiles. The lowest percent recovery of 60% is from 1,2,4-trichlorobenzene.

Table D-6

SUMMARY OF ACCURACY CORRECTION FACTORS

| | | Accuracy Correction Factor* | | |
|---|---|---|---|---|
| Regulated Pollutant | | Kiln Ash Residue Total Concentration | Scrubber Water** Total Concentration | |
| | | | Proposed | Considered |
| 7. | Carbon tetrachloride | 1.06 | 2.27 | 1.28 |
| 9. | Chlorobenzene | 1.01 | 1.09 | 1.09 |
| 14. | Chloroform | 1.06 | 2.27 | 1.28 |
| 21. | Dichlorodifluoromethane | -- | 2.27 | 1.28 |
| 22. | 1,1-Dichloroethane | 1.06 | 2.27 | 1.28 |
| 23. | 1,2-Dichloroethane | 1.06 | 2.27 | 1.28 |
| 42. | Tetrachloroethene | 1.06 | 2.27 | 1.28 |
| 43. | Toluene | -- | 2.27 | 1.28 |
| 45. | 1,1,1-Trichloroethane | 1.06 | 2.27 | 1.28 |
| 47. | Trichloroethene | 0.93 | 1.19 | 1.19 |
| 68. | Bis(2-chloroethyl)ether | 0.97 | 1.67 | 1.19 |
| 70. | Bis(2-ethylhexyl)phthalate | 0.97 | -- | -- |
| 88. | p-Dichlorobenzene | 1.11 | 1.47 | 1.47 |
| 98. | Di-n-butylphthalate | 0.97 | 1.67 | 1.19 |
| 109. | Fluorene | 9.97 | 1.67 | 1.19 |
| 110. | Hexachlorobenzene | 0.97 | 1.67 | 1.19 |
| 113. | Hexachloroethane | 0.97 | 1.67 | 1.19 |
| 121. | Naphthalene | 0.97 | 1.67 | 1.19 |
| 136. | Pentachlorobenzene | 0.97 | 1.67 | 1.19 |
| 141. | Phenanthrene | 0.97 | 1.67 | 1.19 |
| 148. | 1,2,4,5-Tetrachlorobenzene | 0.97 | 1.67 | 1.19 |
| 150. | 1,2,4-Trichlorobenzene | 1.33 | 1.67 | 1.67 |

*The Accuracy Corrrection factor is equal to 100 divided by the Percent Recovery.

**Accuracy correction factors determined by the method used in the proposed rule and the method considered for the final rule are presented here.

Table D-7

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| Spike Constituent | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| VOLATILES | | | | | | | |
| 4. Benzene | <2 | 25 | 21 | 84 | 25 | 17 | 68 |
| 7. Carbon Tetrachloride | ** | | | | | | |
| 9. Chlorobenzene | <2 | 25 | 29 | 116 | 25 | 23 | 92 |
| 14. Chloroform | ** | | | | | | |
| 21. Dichlorodifluoromethane | ** | | | | | | |
| 22. 1,1-Dichloroethane | ** | | | | | | |
| 23. 1,2-Dichloroethane | ** | | | | | | |
| 24. 1,1-Dichloroethylene | <2 | 25 | 12 | 48 | 25 | 11 | 44 |
| 42. Tetrachloroethene | ** | | | | | | |
| 43. Toluene | ** | | | | | | |

*Percent recovery $= 100$ x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 78% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 84% from both sample results.

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| Spike Constituent | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| VOLATILES (Continued) | | | | | | | |
| 45. 1,1,1-Trichloroethane ** | | | | | | | |
| 47. Trichloroethene | <2 | 25 | 21 | 84 | 25 | 27 | 108 |
| AVERAGE PERCENT RECOVERY FOR VOLATILE | | | | 83 | | | 78 |
| SEMIVOLATILES (Base/Neutral Fraction) | | | | | | | |
| 52. Acenaphthene | <5 | 50 | 51 | 102 | 50 | 51 | 102 |
| 68. Bis(2-chloroethyl)ether + | | | | | | | |
| 88. 1,4-Dichlorobenzene | <2 | 50 | 34 | 68 | 50 | 35 | 70 |
| 98. Di-n-butylphthalate + | | | | | | | |
| 102. 2,4-Dinitrotoluene | <2 | 50 | 43 | 86 | 50 | 42 | 84 |
| 105. N-Nitroso-di-n-propylamine | <5 | 50 | 50 | 100 | 50 | 46 | 92 |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 78% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 84% from both sample results.

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER

| Spike Constituent | Original Amount Found (ppb) | Sample Result | | | Duplicate Sample Result | | |
|---|---|---|---|---|---|---|---|
| | | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery (%) | Amount Spiked (ppb) | Amount Recovered (ppb) | Percent* Recovery % |
| SEMIVOLATILES (Continued) | | | | | | | |
| 109. Fluorene | + | | | | | | |
| 110. Hexachlorobenzene | + | | | | | | |
| 113. Hexachloroethane | + | | | | | | |
| 121. Naphthalene | + | | | | | | |
| 136. Pentachlorobenzene | + | | | | | | |
| 141. Phenanthrene | + | | | | | | |
| 145. Pyrene | <2 | 50 | 43 | 86 | 50 | 43 | 86 |
| 148. 1,2,4,5-Tetrachloro-benzene | + | | | | | | |
| 150. 1,2,4-Trichlorobenzene | <10 | 50 | 30 | 60 | 50 | 34 | 68 |
| AVERAGE PERCENT RECOVERY FOR SEMIVOLATILES (BASE/NEUTRALS) | | | | 84 | | | 84 |

*Percent recovery = 100 x $(C_i - C_o)/C_t$, where $C_i$ = amount recovered, $C_o$ = original amount found, and $C_t$ = amount spiked.

**No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the volatile constituents. The lower average percent recovery is 78% from the duplicate sample result.

+No matrix spike was performed for this constituent. The percent recovery determined for this constituent to be considered for the final rule is based on the lower average percent recovery of the semivolatile (base/neutral) constituents. The lower average percent recovery is 84% from both sample results.

Table D-8

Calculation of BDAT Treatment Standards in Proposed Rule

Waste Code: K019

(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 |
| **7.Carbon tetrachloride** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| **9.Chlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.087 | 1.087 | 1.087 | 1.087 | 1.087 | 1.087 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| **14.Chloroform** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| **21.Dichlorodifluoromethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.004 | 0.014 | 0.002 | 0.002 |
| a or dl | dl | dl | a | a | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.010 | 0.032 | 0.005 | 0.005 |
| **22.1,1-Dichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

Table D-8 (Cont.)
Calculation of BDAT Treatment Standards in Proposed Rule(Cont.)
Waste Code: K019
(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| Constituent | 1 | 2 | 3 | 4 | 5 | 6 |
| **23.1,2-Dichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| **42.Tetrachloroethene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| **43.Toluene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.003 | 0.003 | 0.005 | 0.002 | 0.002 |
| a or dl | dl | a | a | a | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.007 | 0.006 | 0.010 | 0.005 | 0.005 |
| **45.1,1,1-Trichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 | 2.273 |
| adjusted value (mg/l)** | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| **47.Trichloroethene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

## Table D-8 (Cont.)
### Calculation of BDAT Treatment Standards in Proposed Rule(Cont.)
### Waste Code: K019
### (Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| Constituent | 1 | 2 | 3 | 4 | 5 | 6 |
| **68.Bis(2-chloroethyl)ether** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **88.p-Dichlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.471 | 1.471 | 1.471 | 1.471 | 1.471 | 1.471 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **98.Di-n-butyl phthalate** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.006 | 0.005 | 0.004 | 0.003 | 0.003 |
| a or dl | dl | a | a | a | a | a |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.003 | 0.011 | 0.008 | 0.007 | 0.005 | 0.004 |
| **109.Fluorene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **110.Hexachlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

Table D-8 (Cont.)
Calculation of BDAT Treatment Standards in Proposed Rule(Cont.)
Waste Code: K019
[Scrubber Water Composition]

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **113.Hexachloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| **121.Naphthalene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **136.Pentachlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| **141.Phenanthrene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **148.1,2,4,5-Tetrachlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

Calculation of BDAT Treatment Standards in Proposed Rule(Cont.)

Waste Code: K019

(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| Constituent | 1 | 2 | 3 | 4 | 5 | 6 |
| 150.1,2,4-Trichlorobenzene | | | | | | |
| unadjusted value (mg/l) | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

* Accuracy Correction Factors are presented in Table D-6.
** Adjusted value = (Unadjusted value) x (ACF)

Table D-9.
Calculation of BDAT Treatment Standards Considered in Promulgation
Waste Code: K019
(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **7.Carbon tetrachloride** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **9.Chlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.087 | 1.087 | 1.087 | 1.087 | 1.087 | 1.087 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| **14.Chloroform** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **21.Dichlorodifluoromethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.004 | 0.014 | 0.002 | 0.002 |
| a or dl | dl | dl | a | a | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.006 | 0.018 | 0.003 | 0.003 |
| **22.1,1-Dichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |

* Accuracy Correction Factors are presented in Table D-6.
** Adjusted value = (Unadjusted value) x (ACF)

Table D-9 (Cont.)[1]

Calculation of BDAT Treatment Standards Considered in Promulgation(Cont)

Waste Code: K019

(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **23.1,2-Dichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **42.Tetrachloroethene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **43.Toluene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.003 | 0.003 | 0.005 | 0.002 | 0.002 |
| a or dl | dl | a | a | a | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.004 | 0.003 | 0.006 | 0.003 | 0.003 |
| **45.1,1,1-Trichloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 | 1.282 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **47.Trichloroethene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

Table D-9 (Cont.)

Calculation of BDAT Treatment Standards Considered in Promulgation(Cont)

Waste Code: K019

(Scrubber Water Composition)

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- |
| 68.Bis(2-chloroethyl)ether | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 88.p-Dichlorobenzene | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.471 | 1.471 | 1.471 | 1.471 | 1.471 | 1.471 |
| adjusted value (mg/l)** | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| 98.Di-n-butyl phthalate | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.006 | 0.005 | 0.004 | 0.003 | 0.003 |
| a or dl | dl | a | a | a | a | a |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.008 | 0.005 | 0.005 | 0.003 | 0.003 |
| 109.Fluorene | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 110.Hexachlorobenzene | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |

* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

## Table D-9 (Cont.)

### Calculation of BDAT Treatment Standards Considered in Promulgation(Cont)
#### Waste Code: K019
#### [Scrubber Water Composition]

This table presents the calculations of the corrected analytical values for constituents which were detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **113.Hexachloroethane** | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| **121.Naphthalene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| **136.Pentachlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| **141.Phenanthrene** | | | | | | |
| unadjusted value (mg/l) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| **148.1,2,4,5-Tetrachlorobenzene** | | | | | | |
| unadjusted value (mg/l) | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 | 1.190 |
| adjusted value (mg/l)** | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |

\* Accuracy Correction Factors are presented in Table D-6.

** Adjusted value = (Unadjusted value) x (ACF)

Calculation of BDAT Treatment Standards Considered in Promulgation(Cont)

Waste Code: K019

[Scrubber Water Composition]

This table presents the calculations of the corrected analytical values for constituents which were
detected in the untreated or the treated waste, using the accuracy correction factors*(ACF). Note that
when a constituent is not detected in the ash the unadjusted analytical value is set equal to the
detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl",
respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 150.1,2,4-Trichlorobenzene | | | | | | |
| unadjusted value (mg/l) | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 | 1.667 |
| adjusted value (mg/l)** | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |

* Accuracy Correction Factors are presented in Table D-8.

** Adjusted value = (Unadjusted value) x (ACF)

Calculation of BDAT Treatment Standards
Waste Code: K019

(Rotary Kiln Incinerator Ash Composition)

This table presents the calculations of the corrected analytical values for constituents which are detected in the untreated or treated waste using the acurracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **7. Carbon tetrachloride** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |
| **9. Chlorobenzene** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.010 | 1.010 | 1.010 | 1.010 | 1.010 | 1.010 |
| adjusted value (mg/kg)** | 2.020 | 2.020 | 2.020 | 2.020 | 2.020 | 2.020 |
| **14. Chloroform** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |
| **22. 1,1-Dichloroethane** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |
| **23. 1,2-Dichloroethane** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |

* Accuracy Correction Factors are presented in Table D-6
** Adjusted value = (Unadjusted value) x (ACF)

Calculation of BDAT Treatment Standards (Continued)

Waste Code: K019

(Rotary Kiln Incinerator Ash Composition)

This table presents the calculations of the corrected analytical values for constituents which are detected in the untreated or treated waste using the acurracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **42.Tetrachloroethene** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |
| **45.1,1,1-Trichloroethane** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 | 1.064 |
| adjusted value (mg/kg)** | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 | 2.128 |
| **47.Trichloroethene** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.935 | 0.935 | 0.935 | 0.935 | 0.935 | 0.935 |
| adjusted value (mg/kg)** | 1.869 | 1.869 | 1.869 | 1.869 | 1.869 | 1.869 |
| **68.Bis(2-chloroethyl)ether** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 |
| **70. Bis(2-ethylhexyl)phthalate** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 12.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | a | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 11.650 | 1.942 | 1.942 |

* Accuracy Correction Factors are presented in Table D-6

** Adjusted value = (Unadjusted value) x (ACF)

Table D-10 (Continued)
Calculation of BDAT Treatment Standards (Continued)
Waste Code: K019
(Rotary Kiln Incinerator Ash Composition)

This table presents the calculations of the corrected analytical values for constituents which are detected in the untreated or treated waste using the acurracy correction factors*(ACF). Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

| Constituent | Sample Set | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **98. Di-n-butyl phthalate** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 230.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | a | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 223.301 | 1.942 | 1.942 |
| **109. Fluorene** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 |
| **110. Hexachlorobenzene** | | | | | | |
| unadjusted value (mg/kg) | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 |
| **113. Hexachloroethane** | | | | | | |
| unadjusted value (mg/kg) | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 |
| **121. Naphthalene** | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 |

* Accuracy Correction Factors are presented in Table D-6
** Adjusted value = (Unadjusted value) x (ACF)

Table D-10 (Continued)
Calculation of BDAT Treatment Standards (Continued)
Waste Code: K019
[Rotary Kiln Incinerator Ash Composition]

This table presents the calculations of the corrected analytical values for constituents which are detected in the untreated or treated waste using the acurracy correction factors*[ACF]. Note that when a constituent is not detected in the ash the unadjusted analytical value is set equal to the detection limit. The unadjusted analytical values and detection limits are labeled "a" and "dl", respectively.

|  | Sample Set | | | | | |
|---|---|---|---|---|---|---|
| Constituent | 1 | 2 | 3 | 4 | 5 | 6 |
| 136.Pentachlorobenzene | | | | | | |
| unadjusted value (mg/kg) | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 | 10.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 | 9.709 |
| 141.Phenanthrene | | | | | | |
| unadjusted value (mg/kg) | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 | 1.942 |
| 148.1,2,4,5-Tetrachlorobenzene | | | | | | |
| unadjusted value (mg/kg) | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 | 0.971 |
| adjusted value (mg/kg)** | 4.854 | 4.854 | 4.854 | 4.854 | 4.854 | 4.854 |
| 150.1,2,4-Trichlorobenzene | | | | | | |
| unadjusted value (mg/kg) | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 |
| a or dl | dl | dl | dl | dl | dl | dl |
| ACF | 1.333 | 1.333 | 1.333 | 1.333 | 1.333 | 1.333 |
| adjusted value (mg/kg)** | 6.667 | 6.667 | 6.667 | 6.667 | 6.667 | 6.667 |

* Accuracy Correction Factors are presented in Table D-6
** Adjusted value= (Unadjusted value) x (ACF)

Appendix E

WASTE CHARACTERISTICS AFFECTING PERFORMANCE

APPENDIX E

CONSTITUENT BOILING POINTS

| Constituent | Boiling Point ($^{O}$C) | Reference Number |
|---|---|---|
| 7. Carbon tetrachloride | 76.7-77 | 1 |
| 9. Chlorobenzene | 131-132 | 1 |
| 12. Chloroethane | 12-12.3 | 1 |
| 14. Chloroform | 61-62 | 1 |
| 15. Chloromethane | (-24)-(-23.7) | 1 |
| 22. 1,1-Dichloroethane | 57-57.3 | 1 |
| 23. 1,2-Dichloroethane | 83-84 | 1 |
| 226. Ethyl benzene | 136.25 | 1 |
| 41. 1,1,2,2-Tetrachloroethane | 146.5-147 | 1 |
| 42. Tetrachloroethane | 121 | 1 |
| 45. 1,1,1-Trichloroethane | 74-74.1 | 1 |
| 46. 1,1,2-Trichloroethane | 113-114 | 1 |
| 47. Trichloroethene | 86.7-87 | 1 |
| 68. Bis(2-chloroethyl)ether | 178 | 1 |
| 70. Bis(2-ethylhexyl)phthalate | 385 | 2 |
| 87. o-Dichlorobenzene | 180.5-181 | 1 |
| 88. p-Dichlorobenzene | 174-174.12 | 1 |
| 98. Di-n-butyl phthalate | 340 | 1 |
| 109. Fluorene | 295 | 1 |
| 110. Hexachlorobenzene | 323-326 | 1 |
| 111. Hexachlorobutadiene | 210-220 | 2 |
| 112. Hexachlorocyclopentadiene | 234 | 2 |
| 113. Hexachloroethane | 186.8-187 | 1 |
| 115. Hexachloropropene | 209-210 | 3 |
| 121. Naphthalene | 217.9-218 | 1 |
| 136. Pentachlorobenzene | 275-277 | 2 |
| 137. Pentachloroethane | 161-162 | 1 |
| 141. Phenanthrene | 340 | 1 |
| 148. 1,2,4,5-Tetrachlorobenzene | 246 | 2 |
| 150. 1,2,4-Trichlorobenzene | 213 | 1 |

1 = Merck Index (Reference 15).

2 = Handbook of Environmental Data on Organic Chemicals (Reference 16).

3 = Handbook of Chemistry and Physics (Reference 17).

BOND DISSOCIATION ENERGIES

| Constituent | Bond Dissociation Energy |
|---|---|
| 7. Carbon tetrachloride | 347 |
| 9. Chlorobenzene | 1320 |
| 12. Chloroethane | 665 |
| 14. Chloroform | 350 |
| 15. Chloromethane | 380 |
| 22. 1,1-Dichloroethane | 645 |
| 23. 1,2-Dichloroethane | 645 |
| 41. 1,1,2,2-Tetrachloroethane | 605 |
| 42. Tetrachloroethene | 461 |
| 45. 1,1,1-Trichloroethane | 625 |
| 46. 1,1,2-Trichloroethane | 625 |
| 47. Trichloroethene | 481 |
| 68. Bis(2-chloroethyl)ether | 1290 |
| 70. Bis(2-ethylhexyl)phthalate | 6610 |
| 87. o-Dichlorobenzene | 1325 |
| 88. p-Dichlorobenzene | 1325 |
| 98. Di-n-butyl phthalate | 4340 |
| 109. Fluorene | 2700 |
| 110. Hexachlorobenzene | 1310 |
| 111. Hexachlorobutadiene | 853 |
| 112. Hexachlorocyclopentadiene | 1020 |
| 113. Hexachloroethane | 565 |
| 115. Hexachloropropene | 710 |
| 121. Naphthalene | 2095 |
| 136. Pentachlorobenzene | 1310 |
| 137. Pentachloroethane | 585 |
| 141. Phenanthrene | 2900 |
| 148. 1,2,4,5-Tetrachlorobenzene | 1320 |
| 150. 1,2,4-Trichlorobenzene | 1320 |

Sources:
    Sanderson, R.T. Chemical Bonds and Bond Energy (Reference 14).
    Lange's Handbook of Chemistry (Reference 12).
    Handbook of Chemistry and Physics (Reference 17).

# CALCULATION OF THERMAL CONDUCTIVITY FOR

## WASTE TREATED AT PLANT A

Calculation of weight fractions of K019 and RCRA blend waste in the total feed stream:

From the Rollins OER (Reference 10) K019 waste and RCRA blend waste each comprised approximately 50 percent of the total waste stream.

$$X \text{ K019} = 50\%$$
$$X \text{ RCRA} = 50\%$$

Major constituent analysis:

From sections 2.1.2 and 2.2.2 in the Rollins OER (Reference 10) the major constituent composition of K019 and RCRA blend is as follows:

| Constituent | K019 (%) | RCRA (%) |
|---|---|---|
| Water | 2 | 50 |
| 1,1,2-Trichloroethane | 4 | -- |
| 1,2-Dichloroethane | 10 | -- |
| Chlorinated Solvents | -- | 10 |
| Oil | -- | 39 |
| Other BDAT Constituents | 2 | 1 |
| Other Organic Constituents | 82 | -- |

Since the thermal conductivities of organic constituents are similar, the major constituent analysis can be simplified as follows:

| Constituent | K019 (%) | RCRA (%) |
|---|---|---|
| Water | 2 | 50 |
| Organic Constituents | 98 | 11 |
| Oil | -- | 39 |

## Major constituent composition of the total waste stream:

The composition of the total waste stream is calculated as follows:

% Water = (% water in K019)(X K019) + (% water in RCRA)(X RCRA)
       = (2)(0.50) + (50)(0.50)
       = 26

% Organics = (%organics in K019)(X K019) + (% organics in RCRA)
            (X RCRA)
          = (98)(0.50) + (11)(0.50)
          = 54

% Oil   = (% oil in K019)(X K019) + (% oil in RCRA)(X RCRA)
        = (0)(0.50) + (39)(0.50)
        = 20

## Thermal conductivity (k) of major constituents:

From Lange's Handbook of Chemistry (Reference 18) the thermal conductivities (k) for the major constituents are:

k water = 0.329 BTU/hr ft $^\circ$F @ 54$^\circ$F
k organics = 0.10 BTU/hr ft $^\circ$F @ 68$^\circ$F
k gasoline = 0.078 BTU/hr ft $^\circ$F @ 86$^\circ$F

In the absence of thermal conductivity values for oil we have used the thermal conductivity value for gasoline for the purposes of this calculation. The thermal conductivity of organics represents an average thermal conductivity for organic compounds.

## Calculations of the overall waste thermal conductivity:

Using the major constituent compositions of the total waste stream and the thermal conductivities presented above, the calculations of the overall waste thermal conductivity is as follows:

k overall = (% water) (k water) + (% Oil)(k gasoline) +
           (% organics)(k organics)
         = (0.26)(0.329 BTU/hr ft $^\circ$F) + (0.20)(0.078 BTU/hr
           ft $^\circ$F) + (0.54)(0.10 BTU/hr ft $^\circ$F)
         = 0.16 BTU/hr ft $^\circ$F

APPENDIX F

DETECTION LIMITS FOR UNTREATED WASTES

## TABLE 6-2A: K019 WASTE BDAT LIST CONSTITUENT DETECTION LIMITS (VOLATILES)

| BDAT CONSTITUENT | DETECTION LIMIT ** SAMPLE SET #1 | DETECTION LIMIT ** SAMPLE SETS #2 THROUGH #6 |
|---|---|---|
| VOLATILE CONSTITUENTS: | [ppm] | [ppm] |
| 1 Acetonitrile | 1000 | 10000 |
| 2 Acrolein | 10000 | 100000 |
| 3 Acrylonitrile | 1000 | 10000 |
| 4 Benzene | 2000 | 2000 |
| 5 Bromodichloromethane | 200 | 2000 |
| 6 Bromomethane | 200 | 2000 |
| 7 Carbon tetrachloride | 2000 | 2000 |
| 8 Carbon disulfide | NA | NA |
| 9 Chlorobenzene | 2000 | 2000 |
| 10 2-Chloro-1,3-butadiene | 200 | 2000 |
| 11 Chlorodibromomethane | 200 | 2000 |
| 12 Chloroethane | 200 | 2000 |
| 13 2-Chloroethyl vinyl ether | NA | NA |
| 14 Chloroform | 2000 | 2000 |
| 15 Chloromethane | 200 | 2000 |
| 16 3-Chloropropene | 200 | 2000 |
| 17 1,2-Dibromo-3-chloropropane | 200 | 2000 |
| 18 1,2-Dibromoethane | 200 | 2000 |
| 19 Dibromomethane | 200 | 2000 |
| 20 Trans-1,4-dichloro-2-butene | 10000 | 10000 |
| 21 Dichlorodifluoromethane | 200 | 2000 |
| 22 1,1-Dichloroethane | 2000 | 2000 |
| 23 1,2-Dichloroethane | 2000 | 2000 |
| 24 1,1-Dichloroethylene | 200 | 2000 |
| 25 Trans-1,2-dichloroethene | 200 | 2000 |
| 26 1,2-Dichloropropane | 500 | 5000 |
| 27 Trans-1,3-dichloropropene | 500 | 5000 |
| 28 cis-1,3-Dichloropropene | 500 | 5000 |
| 29 1,4-Dioxane | NA | NA |
| 30 Ethyl cyanide | 10000 | 100000 |
| 31 Ethyl methacrylate | 200 | 2000 |
| 32 Iodomethane | 200 | 2000 |
| 33 Isobutyl alcohol | 200 | 2000 |
| 34 Methyl ethyl ketone | 1000 | 10000 |
| 35 Methyl methacrylate | 200 | 2000 |
| 37 Methylacrylonitrile | 1000 | 10000 |
| 38 Methylene chloride | 1000 | 10000 |
| 40 1,1,1,2-Tetrachloroethane | 200 | 2000 |
| 41 1,1,2,2-Tetrachloroethane | 2000 | 2000 |
| 42 Tetrachloroethene | 2000 | 2000 |
| 43 Toluene | 200 | 2000 |
| 44 Tribromomethane | 200 | 2000 |
| 45 1,1,1-Trichloroethane | 200 | 2000 |
| 46 1,1,2-Trichloroethane | 2000 | 2000 |
| 47 Trichloroethene | 2000 | 2000 |
| 48 Trichloromonofluoromethane | 200 | 2000 |
| 49 1,2,3-Trichloropropane | 500 | 5000 |

F-1

TABLE 6-2A:  K019 WASTE BDAT LIST CONSTITUENT DETECTION LIMITS (VOLATILES)

| BDAT CONSTITUENT | DETECTION LIMIT ** SAMPLE SET #1 | DETECTION LIMIT ** SAMPLE SETS #2 THROUGH #6 |
|---|---|---|
| 50  Vinyl chloride | 200 | 2000 |
| 79  3-Chloropropionitrile + | NA | NA |
| *  Acetone | 1000 | 10000 |
| *  Allyl alcohol | NA | NA |
| *  Ethyl benzene | 200 | 2000 |
| *  Ethylene oxide | NA | NA |
| *  2-Hexanone | 1000 | 10000 |
| *  Malononitrile | NA | NA |
| *  4-Methyl-2-pentanone | 1000 | 10000 |
| *  2-Propyn-1-ol | NA | NA |
| *  Styrene | 200 | 2000 |
| *  Trichloromethanethiol | NA | NA |
| *  Vinyl acetate | 200 | 2000 |
| *  Xylene [total] | 200 | 2000 |

NA The standard is not available; the compound was searched using an NBS
   library database of 42,000 compounds.

*  This constituent is not on the list of constituents in the GENERIC QUALITY
   ASSURANCE PROJECT PLAN FOR LAND DISPOSAL RESTRICTIONS PROGRAM ("BDAT"),
   EPA/530-SW-87-011, March 1987.  It is a ground-water monitoring constituent
   as listed in Appendix IX, Page 26639, of the FEDERAL REGISTER, Vol. 51, No. 142.

** Sample set #1 was diluted by a factor of ten, analyzed, and quantitated.
   Even at this dilution, several target analytes were outside the calibration
   range.  These analytes were quantitated after reanalysis of the sample at a
   dilution factor of 100.  The detection limits for sample set #1 are based
   on the ten factor dilution.  Because sample set #2 through #6 were similar
   matrices to that of sample set #1, they were diluted by a factor of 100
   before any analyses were performed.

+  The compound appears in the GENERIC QUALITY ASSURANCE PROJECT PLAN
   as a semivolatile constituent but was analyzed as a volatile constituent.

TABLE 6-28: K019 WASTE BDAT LIST CONSTITUENT DETECTION LIMITS (NON-VOLATILES)

| BDAT CONSTITUENT | DETECTION LIMIT | BDAT CONSTITUENT | DETECTION LIMIT |
|---|---|---|---|
| SEMIVOLATILE CONSTITUENTS: | [ppm] | SEMIVOLATILE CONSTITUENTS: | [ppm] |
| 36 Methyl methanesulfonate + | 50 | 97 Dimethyl phthalate | 10 |
| 39 Pyridine + | 100 | 98 Di-n-butyl phthalate | 10 |
| 51 Acenaphthalene | 10 | 99 1,4-Dinitrobenzene | 50 |
| 52 Acenaphthene | 10 | 100 4,6-Dinitro-o-cresol | 250 |
| 53 Acetophenone | 10 | 101 2,4-Dinitrophenol | 250 |
| 54 2-Acetylaminofluorene | NA | 102 2,4-Dinitrotoluene | 250 |
| 55 4-Aminobiphenyl | 10 | 103 2,6-Dinitrotoluene | 50 |
| 56 Aniline | 25 | 104 Di-n-octyl phthalate | 10 |
| 57 Anthracene | 10 | 105 Di-n-propylnitrosoamine | 25 |
| 58 Aramite | NA | 106 Diphenylamine | 10 |
| 59 Benz[a]anthracene | 10 | 107 1,2-Diphenylhydrazine | 10 |
| 60 Benzenethiol | NA | 108 Fluoranthene | 10 |
| 61 Benzidine | 10 | 109 Fluorene | 10 |
| 62 Benzo[a]pyrene | 10 | 110 Hexachlorobenzene | 50 |
| 63 Benzo[b]fluoranthene | NA | 111 Hexachlorobutadiene | 50 |
| 64 Benzo[g,h,i]perylene | 25 | 112 Hexachlorocyclopentadiene | 50 |
| 65 Benzo[k]fluoranthene | 10 | 113 Hexachloroethane | 50 |
| 66 p-Benzoquinone | NA | 114 Hexachlorophene | NA |
| 67 Bis(2-chloroethoxy)ethane | 10 | 115 Hexachloropropene | 50 |
| 68 Bis(2-chloroethyl)ether | 10 | 116 Indeno(1,2,3-cd)pyrene | 10 |
| 69 Bis(2-chloroisopropyl)ether | 10 | 117 Isosafrole | NA |
| 70 Bis(2-ethylhexyl)phthalate | 10 | 118 Methapyrilene | NA |
| 71 4-Bromophenyl phenyl ether | 50 | 119 3-Methylcholanthrene | NA |
| 72 Butyl benzyl phthalate | 10 | 120 4,4'-Methylenebis(2-chloroaniline) | NA |
| 73 2-sec-Butyl-4,6-dinitrophenol | NA | 121 Naphthalene | 10 |
| 74 p-Chloroaniline | 25 | 122 1,4-Naphthoquinone | 10 |
| 75 Chlorobenzilate | NA | 123 1-Naphthylamine | 10 |
| 76 p-Chloro-m-cresol | 25 | 124 2-Naphthylamine | 10 |
| 77 2-Chloronaphthalene | 10 | 125 p-Nitroaniline | 50 |
| 78 2-Chlorophenol | 10 | 126 Nitrobenzene | 25 |
| 80 Chrysene | NA | 127 4-Nitrophenol | 50 |
| 81 ortho-Cresol | 10 - | 128 N-Nitrosodi-n-butylamine | 25 |
| 82 para-Cresol | 10 | 129 N-Nitrosodiethylamine | 50 |
| 83 Dibenz[a,h]anthracene | 10 | 130 N-Nitrosodimethylamine | 100 |
| 84 Dibenzo[a,e]pyrene | NA | 131 N-Nitrosomethylethylamine | NA |
| 85 Dibenzo[a,i]pyrene | NA | 132 N-Nitrosomorpholine | 50 |
| 86 m-Dichlorobenzene | 10 | 133 N-Nitrosopiperidine | 50 |
| 87 o-Dichlorobenzene | 10 | 134 N-Nitrosopyrrolidine | 50 |
| 88 p-Dichlorobenzene | 10 | 135 5-Nitro-o-toluidine | NA |
| 89 3,3'-Dichlorobenzidine | 50 | 136 Pentachlorobenzene | 50 |
| 90 2,4-Dichlorophenol | 25 | 137 Pentachloroethane | 50 |
| 91 2,6-Dichlorophenol | 25 | 138 Pentachloronitrobenzene | 50 |
| 92 Diethyl phthalate | 10 | 139 Pentachlorophenol | 250 |
| 93 3,3'-Dimethoxybenzidine | 50 | 140 Phenacetin | 10 |
| 94 p-Dimethylaminoazobenzene | 25 | 141 Phenanthrene | 10 |
| 95 3,3'-Dimethylbenzidine | NA | 142 Phenol | 10 |
| 96 2,4-Dimethylphenol | 25 | 143 2-Picoline | 100 |

TABLE 6-2B:  K019 WASTE BDAT LIST CONSTITUENT DETECTION LIMITS (NON-VOLATILES)

| BDAT CONSTITUENT | DETECTION LIMIT | BDAT CONSTITUENT | DETECTION LIMIT |
|---|---|---|---|
| SEMIVOLATILES (CONTINUED): | [ppm] | METALS: | [ppm] |
| 144 Pronamide | 50 | 154 Antimony | 6 |
| 145 Pyrene | 10 | 155 Arsenic | 0.2 |
| 146 Resorcinol | NA | 156 Barium | 0.9 |
| 147 Safrole | NA | 157 Beryllium | 0.1 |
| 148 1,2,4,5-Tetrachlorobenzene | 25 | 158 Cadmium | 0.3 |
| 149 2,3,4,6-Tetrachlorophenol | 50 | 159 Chromium | 0.9 |
| 150 1,2,4-Trichlorobenzene | 25 | 159 Chromium, hexavalent | 0.2 |
| 151 2,4,5-Trichlorophenol | 50 | 160 Copper | 1 |
| 152 2,4,6-Trichlorophenol | 50 | 161 Lead | 0.2 |
| 153 Tris(2,3-dibromopropyl) phosphate | NA | 162 Mercury | 0.05 |
| * 7,12-Dimethylbenz(a)anthracene | 25 | 163 Nickel | 2 |
| * alph,alpha-Dimethylphenethylamine | 50 | 164 Selenium | 0.5 |
| * Benzoic acid | 250 | 165 Silver | 0.9 |
| * Benzyl alcohol | 25 | 166 Thallium | 0.2 |
| * 4-Chlorophenyl phenyl ether | 25 | 167 Vanadium | 2 |
| * Dibenzofuran | 10 | 168 Zinc | 0.6 |
| * Dibenzo(a,h)pyrene | NA | | |
| * Isophorone | 10 | OTHER CONSTITUENTS: | |
| * 2-Methylnaphthalene | 10 | | |
| * 2-Nitroaniline | 50 | 169 Total Cyanide (ppm) | 0.5 |
| * 3-Nitroaniline | 50 | 170 Fluoride (ppm) | 5 |
| * 2-Nitrophenol | 50 | 171 Sulfide (ppm) | 50 |
| * N-Nitrosodiphenylamine | 10 | Chlorine (%) | 0.3 |

PHYSICAL PARAMETERS:

| | |
|---|---|
| Ash Content (%) | 0.01 |
| Heating Value (Btu/lb) | 100 |
| Total Solids (% residual) | 0.05 |
| Paint Filter Test (% free liquid) | 0.5 |

NA  The standard is not available; the compound was searched using an NBS library database of 42,000 compounds.

*  This constituent is not on the list of constituents in the GENERIC QUALITY ASSURANCE PROJECT PLAN FOR LAND DISPOSAL RESTRICTIONS PROGRAM ("BDAT"), EPA/530-SW-87-011, March 1987.  It is a ground-water monitoring constituent as listed in Appendix IX, Page 26639, of the FEDERAL REGISTER, Vol. 51, No. 142.

+  The compound appears in the GENERIC QUALITY ASSURANCE PROJECT PLAN as a volatile constituent but was analyzed as a semivolatile constituent.

In this background document supporting the proposed rule for chlorinated organic wastes K016, K018, K019, K020, and K030, EPA presented two methods for calculation of BDAT treatment standards for wastewater:

(1)  The currently accepted calculation method (referred to as the method to be considered for promulgation in the background document); and

(2)  A second method based on an earlier calculation methodology (referred to as the proposal method in the background document).

On April 8, 1988, EPA proposed BDAT treatment standards for K016, K018, K019, K020, and K030 wastewaters based on the currently accepted calculation method (53 Federal Register 11755, April 8, 1988). The following tables present the correct treatment standards for wastewaters and supporting results for the wastewater treatment standards that were proposed on April 8, 1988:

> Table 4-3, page 4-12
> Table 5-4, page 5-29
> Table 6-13, page 6-30
> Table 6-14, page 6-31
> Table 6-15, page 6-32
> Table 6-16, page 6-33
> Table 6-17, page 6-34
> Table 6-18, page 6-35

The reader is asked to disregard the following tables:

> Wastewater treatment standards in the Executive Summary, page ix.
> Table 4-2, page 4-11
> Table 5-3 (wastewater portion only), page 5-28
> Table 6-7, page 6-24
> Table 6-8, page 6-25
> Table 6-9, page 6-26
> Table 6-10, page 6-27
> Table 6-11, page 6-28
> Table 6-12, page 6-29
> Table 7-2, page 7-8